HONI SOIT QUI MAL Y PENSE
DIEU ET MON DROIT

AGRICULTURAL RESEARCH INSTITUTE
PUSA

The Journal

OF THE

BOARD OF AGRICULTURE.

VOL. XIX.

(April, 1912, to March, 1913.)

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE
By RICHARD CLAY & SONS, Ltd.,
and PUBLISHED by the BOARD OF AGRICULTURE AND FISHERIES.

SUPPLEMENTS TO THE JOURNAL OF THE BOARD OF AGRICULTURE.

No. 1.—Report on Agricultural Education in the United States	Jan., 1908
No. 2.—The Food of Some British Birds ...	Dec., 1908
No. 3.—Reports on the Work of the International Agricultural Institute ...	April, 1910
No. 4.—Wheat: Papers Read at a Meeting of the British Association at Winnipeg, 1909	June, 1910
No. 5.—Influence on the Production of Mutton of Manures Applied to Pasture ...	Jan., 1911
No. 6.—Report on the Work of the International Agricultural Institute ...	July, 1911
No 7.—The Interpretation of the Results of Agricultural Experiments	Nov., 1911
No. 8.—Report on the Isle of Wight Bee Disease	May, 1912
No. 9.—Notes on Kerry Woods, illustrating Methods of Collecting and Utilising Information for a Forest Survey ...	Aug., 1912

CONTENTS.

PAGE

GRANT FROM THE DEVELOPMENT FUND IN RESPECT OF PROVISION OF TECHNICAL ADVICE IN FORESTRY 1

SUPPLY OF STORE AND DAIRY CATTLE. *Alfred Mansell* 3

THE FEEDING OF FARM STOCK: PART III. THE COMPOUNDING OF RATIONS. *Charles Crowther, M.A., Ph.D.* 9

PONDS IN AGRICULTURAL DISTRICTS. *Edward A. Martin, F.G.S.* ... 17

WEEDS IN RELATION TO SOILS. *Winifred E. Brenchley, D.Sc., F.L.S.* ... 20

THE PEA MOTH. *R. S. MacDougall, M.A., D.Sc.* 27

Growth of Linseed for Feedin[illegible] Pr[illegible]

Cultivation of Soy Beans in [illegible]

New Varieties of Wheat ... [illegible]

Damage in Woods due to Squirrel[illegible] 36

Hedge End Agricultural Credit Society ... ... [illegible]

Agricultural Credit and Co-operation in England and Wales 43

Summary of Agricultural Experiments 51
Varieties of Oats and Barley—Varieties of Oats and Potatoes—Growth of Lucerne—Mixtures of Grass and Clover Seeds—Residuary Effects of Manures employed in the Experiments on Grass Land at Levington—Manuring of Turnips—Manurial Requirements of Willows—Self-sterility and Self-fertility in Plums—Cider Sickness—Pollination of Hardy Fruits—"Wart Disease" or "Black Scab" of Potatoes—Streak Disease of Sweet Peas—Spraying of Potatoes—Cabbage-top in Swedes and the Swede Midge—Cattle Feeding Experiments and Manurial Value of Cake.

Official Notices and Circulars 62
Show of Thoroughbred Stallions, 1912—The Wart Disease of Potatoes Order of 1912—Colonial and Foreign Statistics for 1910—Removal of Restrictions on the Importation of Animals into the United States from Great Britain.

Agricultural Machinery Abroad 64
Agricultural Machinery in Algeria—Agricultural Machinery in Uruguay.

Importation Regulations 65
Prohibition of Importation of Cattle, &c., into German South-West Africa from Europe—Importation of Potatoes affected with Wart Disease into Algeria.

Notes on Agriculture Abroad 65
Measures against Tuberculosis of Cattle in Germany.

Notes on the Weather in March 66

Agricultural Conditions in Great Britain in March 67

Notes on Crop Prospects Abroad ... ... [illegible]
Report of the International Agricultural Institute—Germany—Russia and Roumania—United States—India—New South Wales—Argentina—Tasmania.

Live Stock Census in Hungary 70

Prevalence of Animal Diseases on the Continent 70

Agricultural Labour in England during March 72

THE CORN MARKETS IN MARCH. *C. Kains-Jackson* 73

THE LIVE AND DEAD MEAT TRADE IN MARCH. *A. T. Matthews* ... 75

THE PROVISION TRADE IN MARCH. *Hedley Stevens* 77

Statistical Tables, &c. 79

2072
IARI

CONTENTS.

PAGE

HOP GROWING ON THE PACIFIC COAST OF AMERICA. *Arthur Amos, M.A.* 89

THE LIME-SULPHUR WASH FOR USE ON GOOSEBERRIES. *E. S. Salmon, F.L.S.* 99

THE FEEDING OF FARM STOCK: PART IV. RATIONS FOR DAIRY COWS AND OTHER CATTLE. *Charles Crowther, M.A., Ph.D.* 106

CO-OPERATIVE COW INSURANCE SOCIETIES IN 1910 116

Diseases of Raspberry and Loganberry (*with illustration*) 124

Courses in Agricultural Colleges 126

Isle of Wight Bee Disease 133

Summary of Agricultural Experiments 134

Cultivation of Sugar Beet—Growth of Linseed—Varieties of Maize for Forage Purposes—Eradication of Wild Onion—Destruction of Runch by Sulphuric Acid—Wet Rot of Potatoes—Prevention of Damage by Turnip Fly—Protection of Newly-sown Corn from Birds—Tests of Milking Machines—Results of Bacteriological Analyses of Condensed Milks—The Influence of Electricity on the Respiration of Germinating Seeds—The Influence of Weather on Bees—Vitality of Farm Seeds.

Names and Routes of the King's Premium Stallions 142

Official Notices and Circulars 152

Report on Experiments in the Cultivation of Sugar Beet in 1911—Bovine Tuberculosis—Report of Proceedings under the Tithe and other Acts during 1911—American Gooseberry Mildew.

Notes on the Weather in April... 154

Agricultural Conditions in Great Britain in April 154

Notes on Crop Prospects Abroad 155

Report of the International Agricultural Institute—United States—Canada—Russia—Holland—Germany—Prospects of Fruit Crops in California.

Live Stock Census in Croatia and Slavonia 157

Prevalence of Animal Diseases on the Continent 158

Agricultural Labour in England during April 159

THE CORN MARKETS IN APRIL. *C. Kains-Jackson* 160

THE LIVE AND DEAD MEAT TRADE IN APRIL. *A. T. Matthews* ... 163

THE PROVISION TRADE IN APRIL. *Hedley Stevens* 165

Statistical Tables 167

Selected Contents of Periodicals 173

Additions to the Library 174

A Report on the Isle of Wight Bee Disease is issued as a Supplement to the present number of the Journal, price 1/-, post free.

FISONS'

(IPSWICH)

FERTILIZERS.

"The Best in the World."

FOR ROOTS

USE FISONS' FERTILIZERS.

79 Awards in the open classes at the Basingstoke Root Show, 1911, were won by Roots grown with these fertilizers. Special Fertilizers for Mangolds, Swedes, Turnips, Rape, etc. Try them for 1912.

For full particulars of Fertilizers with carriage paid prices and terms, write to Joseph Fison & Co., Ltd, Ipswich.

H. & E. M'GRATH

CATTLE SHEDS.

OFFICES:
Milford Street, LIVERPOOL.
Great Howard St., LIVERPOOL.

HAY & PROVENDER DEALERS. :: :: ::

LIVE STOCK SHIPPING AGENTS

☞ Every attention given to enquiries from breeders wishing to export animals.

Shipments made. Insurance effected. Stock well cared for in our own sheds.

Telegraphic Address: "ANIMALS, LIVERPOOL."
Telephone 1963 and 1944.

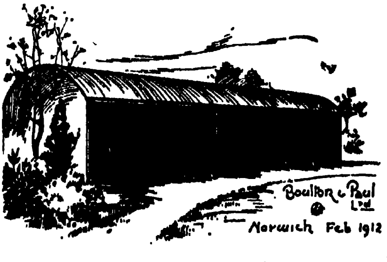
Address Letters to—
H. & E. M'GRATH,
Milford St., LIVERPOOL.

STEEL-FRAMED SHEDS

— for —

HAY OR GRAIN STORES, CART or IMPLEMENT SHEDS,

etc., etc.



No. 160 Shed. Constructed entirely of steel framing, and covered with galvanized corrugated iron sheeting. Size 90 ft. × 30 ft. and 13 ft. high. Can be erected complete in 32 days.

Estimates free on request. Designs submitted to suit any requirements.

Write for Catalogues.

BOULTON & PAUL Ltd.

Engineers, NORWICH.

CONTENTS.

PAGE

YELLOW DISCOLORATION OF STILTON CHEESE (*with coloured Plate*). *John Golding, F.I.C., F.C.S.* 177

HOP GROWING ON THE PACIFIC COAST OF AMERICA. *Arthur Amos, M.A.* 187

THE FEEDING OF FARM STOCK: PART V.—RATIONS FOR YOUNG CATTLE AND FOR SHEEP. *Charles Crowther, M.A., Ph.D.* 196

PIG CLUBS IN ENGLAND AND WALES IN 1910 203

Kemerton and Overbury Pig Club 209

Spurrey as a Forage Crop on Sandy Soils 214

Destruction of Water Weeds 216

Eradication of Foot-and-Mouth Disease 218

The Administration of the Small Holdings Act in 1911 220

Summary of Agricultural Experiments 223

Growth of Linseed—Influence of Weather on Barley, Potatoes and Sugar Beet—Manuring of Mangolds—Manuring of Potatoes—Effect of Sawdust on Plants—Top-dressing Pastures—Experiments with Catalytic Manures—The Inoculation of Red Clover—Mineral Substances in Forest Soils—The Rate of Evolution of Hydrocyanic Acid from Linseed under Digestive Conditions—Horse Poisoning by *Equisetum arvense*—Variation in the Composition of Cow's Milk with Advance of Lactation—Soy Bean Cake for Dairy Cows—The Food of Birds—Effect of Ripeness and Water Content of Seeds on Germinating Capacity—Longevity of Seeds—Influence of Light and Temperature on the Germination of Seeds—The Influence of Electricity on Micro-organisms.

Official Notices and Circulars 233

Harvest Weather Forecasts—Memoir of the Geological Survey—Report of the Proceedings under the Small Holdings and Allotments Acts—Report of the Intelligence Division.

Importation Regulations 234

Importation of Plants into Sierra Leone—Importation of Pedigree Stock for Breeding into the United States—Importation of Plants into the Gold Coast—Control of Plant Diseases in the Netherlands.

Agricultural Exhibition Abroad 235

Exhibition of Horses and Donkeys in Paris.

Notes on Agriculture Abroad 235

Potash from Kelp or Seaweed—Increase in the Productivity of Oats in the Netherlands—Hop Vine Fibre as a Possible Substitute for Hemp—New Norwegian Artificial Manure — Cost of Producing Barley and Potatoes in the United States—Plant Breeding in Germany—Agriculture in the Transvaal and other South African Provinces—Poultry Farming in Europe—Budget of the Swedish Ministry of Agriculture for 1913—Budget of the Austrian Ministry of Agriculture for 1912—Budget of the Hungarian Department of Agriculture for 1912—Agricultural Experiment Stations in Uruguay and Brazil.

Notes on the Weather in May 244

Agricultural Conditions in Great Britain in May 245

Notes on Crop Prospects Abroad 246

Report of the International Agricultural Institute—Netherlands—France—Russia—United States—Germany—Canada—India—Sugar Beet in Russia—Live Stock Census in Argentina.

Prevalence of Animal Diseases on the Continent 249

Agricultural Labour in England during May... 250

THE CORN MARKETS IN MAY. *C. Kains-Jackson* 251

THE LIVE AND DEAD MEAT TRADE IN MAY. *A. T. Matthews* 253

THE PROVISION TRADE IN MAY. *Hedley Stevens* 255

Statistical Tables 257

Selected Contents of Periodicals 263

Additions to the Library 264

CONTENTS.

PAGE

THE FEEDING OF FARM STOCK: PART VI.—RATIONS FOR PIGS AND HORSES. *Charles Crowther, M.A., Ph.D.* 265

THE IDENTIFICATION AND ERADICATION OF SOME COMMON WEEDS. IV.—*H. C. Long, B.Sc., with Drawings from Nature by Bertha Reid* ... 273

PREPARATION OF WILLOWS FOR MARKET. *W. Paulgrave Ellmore and Thomas Okey*... 278

THE CONSTRUCTION OF PIGSTIES... 289

HOP GROWING ON THE PACIFIC COAST OF AMERICA. .*Arthur Amos, M.A.* 294

THE THATCHING OF RICKS. *A. Bradshaw* 301

Progress of Afforestation on Inverliever Estate, Argyllshire 306

Wheat Offals... 308

Necessity for Precaution in Storing Calcium Cyanamide on Farms.. ... 308

Poultry in Great Britain 309

Agricultural Co-operation in Germany 312

Summary of Agricultural Experiments... 313

Potatoes: Varieties and Change of Seed—Varieties of Wheat for Spring Sowing—Varieties of Barley and Oats—Growth of Sugar Beet—The Causes of the High Nutritive Value and Fertility of the Fattening Pastures of Romney and other Marshes in the S.E. of England—Soil Inoculation for Lucerne—Manuring of Meadow Hay, Mangolds, Potatoes and Wheat—Manuring of Mangolds, Swedes and Potatoes—The Chemical Composition of Farmyard Manure as a Measure of its Value. Manure Value of Foods—Heavy Root Feeding and the Dung-heap—Effect of Manganese as a Catalytic Manure—Sulphur as a Manure—Soy Bean Meal for Pigs—Eradication of Cleavers—The Cricket Bat Willow—Distribution of the Nitrogen of Wheat between the Flour, Bran and Shorts—Prevention of Damage by Frost in Orchards.

Official Notices and Circulars 323

Outbreaks of Foot-and-Mouth Disease—Prohibition of Importation of Animals from Great Britain into Ireland—Turning out of Entire Animals on Commons—Fream Memorial Prize—The Agricultural Output of Great Britain—Advisory Council on Horse-Breeding—Warning as to Wart Disease of Potatoes.

Notes on the Weather in June 327

Agricultural Conditions in Great Britain in June 328

Notes on Crop Prospects Abroad 329

Report of the International Agricultural Institute—Sugar Beet—Live Stock Census in Luxemburg—United States.

Fruit Crops in Germany, France, Belgium, and Holland 331

Prevalence of Animal Diseases on the Continent 334

Agricultural Labour in England during June 335

THE CORN MARKETS IN JUNE. *C. Kains-Jackson* 336

THE LIVE AND DEAD MEAT TRADE IN JUNE. *A. T. Matthews* 339

THE PROVISION TRADE IN JUNE. *Hedley Stevens* 341

Statistical Tables 343

Selected Contents of Periodicals 349

Additions to the Library 349

Any of the above Articles may be reproduced in any registered newspaper or public periodical without special permission, provided that the source is acknowledged in each case.

Approved by the Board of Agriculture for Sheep Scab in Great Britain.

IMPROVE THE WOOL

by using

SULAR

(Sulphur and Arsenic).

The Best Powder Dip

Used on millions of Sheep every year, the World over.

12 Packets, **10s.**; 36 Packets, **27s. 6d.**; 72 Packets, **50s.** Carriage Paid.

THE CHEMICAL UNION, Ltd, IPSWICH

H. & E. M'GRATH

CATTLE SHEDS.

OFFICES:

Milford Street, LIVERPOOL.
Great Howard St., LIVERPOOL.

HAY & PROVENDER DEALERS. :: :: ::

LIVE STOCK SHIPPING AGENTS

☞ Every attention given to enquiries from breeders wishing to export animals.

Shipments made. Insurance effected. Stock well cared for in our own sheds.

Telegraphic Address: "ANIMALS, LIVERPOOL."
Telephone 1983 and 1944.

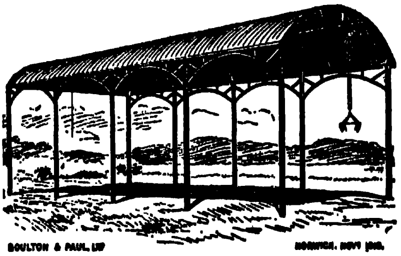
Address Letters to—

H. & E. M'GRATH,
Milford St., LIVERPOOL.

STEEL FRAMED

DUTCH BARNS

FOR HAY OR GRAIN.



These permanent Sheds are now superseding thatch. Once erected they last a lifetime, and save money.

For strength and utility our barns are unequalled, and as we hold large stocks of material, we are able to give prompt delivery.

DESIGNS and ESTIMATES FREE.

We specialise in

STEEL ROOFING of all kinds for FARMS and ESTATES, CARTSHEDS, CATTLE SHELTERS, STOCKYARDS, etc., etc.

Write for Catalogues.

BOULTON & PAUL, LTD.,
Engineers, NORWICH.

CONTENTS.

PAGE

Improvement of Poor Hill Pasture 353

Conference of Agricultural Teachers at Cambridge 360

A Case of Soil Infertility due to Bad Texture and Lack of Lime. *J. A. Hanley, A.R.C.S.* 375

Hop Growing on the Pacific Coast of America. *Arthur Amos, M.A.* 378

Prees Cottagers' Cow Club 388

Preliminary Report on Grant for Horse Breeding 392

The Anthonomus of the Raspberry and Strawberry 394

Population of Agricultural Districts 396

Application of Different Names to the same Variety of Seed 398

Production of Flowers and Fruit in Great Britain 399

Summary of Agricultural Experiments 402
Factors influencing the Availability of Rock Phosphate—Manuring of Meadow Hay—The Effect of Heavy Root Feeding on the Yield and Composition of Milk—The Temperature of Pasteurisation for Butter Making—A Probable Effect of Control of Milk Supply upon Infantile Mortality from Tuberculosis—The Composition of Milk—Effect of Drought on Japanese Larch—Effect of the Drought of 1911 on Forest Trees—Deep Planting of Forest Trees on Sandy Soils.

Official Notices and Circulars 409
Foot-and-Mouth Disease—Prices of Agricultural Produce—Methods of Collecting and Utilising Information for a Forest Survey.

Importation Regulations 411
Importation of Potatoes into South Africa—Prohibition of the Importation of Animals from Great Britain into Various Countries—Importation of Hides and Skins into Roumania—Importation and Sale of Fertilisers in Cape Colony.

Agricultural Exhibitions Abroad 413
Agricultural Exhibition at Khabarovsk—Agricultural Exhibition at Rostov-on-Don.

Agricultural Machinery Abroad 413
Demand for Agricultural Machinery in Russia—Agricultural Machinery in Portuguese East Africa—State Manufacture of Agricultural Implements in Western Australia.

Artificial Manures Abroad 414
Artificial Manures in Russia—Consumption of Artificial Manures in Spain—Demand for Manures in Japan.

Notes on Agriculture Abroad 416
Agricultural Development in Brazil—Budget of the French Ministry of Agriculture for 1912—Agricultural Expansion in South Africa—Market for Tinned Butter in Venezuela—Dutch Phytopathological Service for the Exportation of Plants.

Notes on the Weather in July 417

Agricultural Conditions in Great Britain on August 1st 418

Notes on Crop Prospects Abroad 419
Report of the International Agricultural Institute—Sweden—Germany—Hungary—Canada—United States—Norway—Hop Prospects.

Prevalence of Animal Diseases on the Continent 422

Agricultural Labour in England during July 423

The Corn Markets in July. *C. Kains-Jackson* 424

The Live and Dead Meat Trade in July. *A. T. Matthews* 427

The Provision Trade in July. *Hedley Stevens* 429

Statistical Tables 431

Selected Contents of Periodicals 437

Additions to the Library 437

Any of the above Articles may be reproduced in any registered newspaper or public periodical without special permission, provided that the source is acknowledged in each case

DISINFECT
FARM
PREMISES
WITH

TARBOL

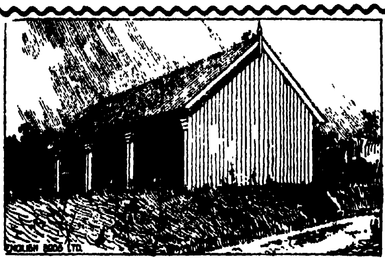
TARBOL prevents the spread of disease. It is a perfect Sheep Dip, Cattle Wash, and Farm Disinfectant.

2 gallon drums, 11/- each.
5 gallon drums, 25/- each.

1 gallon makes 100 gallons of Strong Disinfectant.

Carriage paid to any station.

THE CHEMICAL UNION LTD, IPSWICH.


ENGLISH BROS LTD.

OUR

CREOSOTED WOOD

FARM BUILDINGS, LOOSE BOXES, FIELD SHELTERS

LAST A LIFETIME.

THEY ARE HEALTHY AND ECONOMICAL TO ERECT.

ALSO

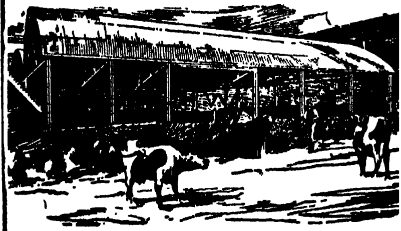
CREOSOTED WOOD FENCING & GATES.

Send for our "BUILDING" Catalogue.

ENGLISH TIMBER BOUGHT AND SOLD.

ENGLISH BROS. LTD.
WISBECH and PETERBOROUGH.

COVERED YARDS FOR CATTLE



We Specialise in all kinds of ECONOMICAL STEEL ROOFING for FARMS and ESTATES.

Cart Sheds, Stock Yards, Iron and Wire Fencing, &c.

Drawings and Estimates Free.

Boulton & Paul, Ltd., Norwich
Showrooms: 128, Queen Victoria St., London, E.C.

CONTENTS.

PAGE

Minimising the Loss caused by Potato Disease 441

Johne's Disease 444

The Formation of Prussic Acid from Linseed Cake and Other Feeding Stuffs. *S. M. J. Auld, D.Sc., Ph.D., F.I.C.* 446

The Food of Nestling Birds. *Walter E. Collinge, M.Sc., F.L.S., F.E.S.* 460

The Aphides on Mangolds and Allied Plants. *Fred. V. Theobald, M.A., F.E.S.* 466

Imports of Grain in the Cereal Year 1911-12 476

The Practical Value of a Soil Analysis 479

Damage to Oats by Fritfly 482

The Dairy Produce of Great Britain 484

Summary of Agricultural Experiments 486

Varieties of Wheat — The Growing of Tobacco for Nicotine Extraction—Investigations on Sugar Beets—Changes in the Composition of the Oat Plant as it Approaches Maturity—Manuring of Potatoes—Sheep Scab Investigations—Johne's Disease in Sheep—Redwater in Cattle—Tobacco Extracts and Nicotine as Insecticides—Finger-and-Toe in Swedes—"Bruise" in Potatoes—Egg Production—Poultry Fattening—The Improvement of the Farm Egg—Autumn and Spring Chicken Rearing—Poultry Houses and Fattening Chickens—Tuberculosis of Fowls—Metabolic Water: Its Production and Rôle in Vital Phenomena—Food of Starlings and Larks.

Official Notices and Circulars 497

Foot-and-Mouth Disease—Misuse of the term "Cattle Plague"—Departmental Committee on the Employment of Veterinary Officers—Grants for Agricultural Instruction—Notice as to Ensilage—Imports and Exports of Agricultural Produce—Research Scholarships in Agricultural Science.

Laying Competition of the Utility Poultry Club 500

Importation Regulations 500

Importation of Potatoes into Jersey—Importation of Sheep and Goats into Belgium—Transit of Animals through France.

Agricultural Exhibitions and Congresses Abroad 501

Tenth International Congress of Agriculture—Panama-Pacific International Exhibition—International Congress of Electroculture.

Notes on Agriculture Abroad 502

Encouragement of Horse Breeding in Belgium—The Beet Sugar Industry in the Netherlands—The Italian Meat Trade—Potatoes in Argentina—Importation of Canadian Cattle at Calais—Treatment of Seaweed for Commercial Purposes in Norway—Premiums for the Construction of Farm Buildings in Italy.

Notes on the Weather in August 504

Area under Crops and Number of Live Stock, 1912 50

Agricultural Conditions in Great Britain on September 1st 506

Notes on Crop Prospects Abroad 508

Report of the International Agricultural Institute—Germany—Hungary—Russia—New South Wales—Potatoes—Hops.

Prevalence of Animal Diseases on the Continent 510

Agricultural Labour in England during August 511

The Corn Markets in August. *C. Kains-Jackson* 512

The Live and Dead Meat Trade in August. *A. T. Matthews* ... 515

The Provision Trade in August. *Hedley Stevens* 517

Statistical Tables 519

Selected Contents of Periodicals 525

Additions to the Library 526

Any of the above Articles may be reproduced in any registered newspaper or public periodical without special permission, provided that the source is acknowledged in each case.

By Appointment to H.M. The King.

FISONS'
(IPSWICH)
FERTILIZERS
FOR
WHEAT
GRASS
FRUIT
WINTER OATS
BEANS AND BARLEY

The sales of these fertilizers increase every year, and for season 1912 reached an unprecedented total.

Full particulars and prices for large or small quantities sent by return of post.

JOSEPH FISON & CO., Ltd, IPSWICH

LIME

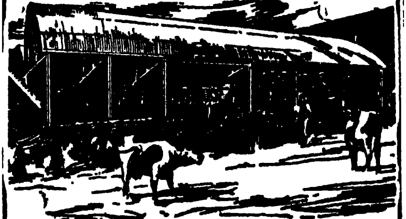
FOR THE LAND.

Nature's Fertiliser
as advised by the
Board of Agriculture.

For quotations apply to

THE TOTTERNHOE LIME Co., Ltd.,
21, Great St. Helens,
LONDON, E.C.

COVERED YARDS FOR CATTLE



We Specialise in all kinds of
ECONOMICAL STEEL ROOFING for
FARMS and ESTATES.

Cart Sheds, Stock Yards, Iron and Wire Fencing, &c.

Drawings and Estimates Free.

Boulton & Paul, Ltd., Norwich
Showrooms: 126, Queen Victoria St., London, E.C.

CONTENTS.

PAGE

The Study of Agricultural Seeds. *W. Borlase, N.D.A.* 529

The Thirty Years' Record of a Grass Orchard. *C. H. Hooper, F.S.I.* 541

Hedge-Cutting and Laying. *A. W. Oldershaw, B.Sc., N.D.A.* ... 546

Navel Ill and Joint Ill in Newly-Born Animals 550

Willow and Poplar Leaf Beetles. *R. Stewart MacDougall, M.A., D.Sc.* 554

The Presence of Tubers on Potato Haulms. *George Massee, F.L.S.*... 560

Physiological Effects of Rations drawn from Restricted Sources... ... 563

Production of Lambs in Autumn and Winter 565

Production of Timber in Great Britain 567

The Development of Agricultural Co-operation in Great Britain... .. 569

Summary of Agricultural Experiments 570

Manuring of Meadow Hay—Some Bacteriological Effects of Liming—The Fertilising Action of Sulphur—Varieties of Wheat—Competition in Cereals—The Hereditary Characters in the Potato—Sprouting Seed Potatoes—Experiments with Lucerne—Sheep Crossing Experiments—Studies of the Protein Nutrition of the Pig—The Feeding of Coconut Cake to Milch Cows—Effect of various Foodstuffs on Milk Secretion and Fat Content of Milk—Feeding Value of Milling Offals—Specific Effect of Foods on Milk Production—Feeding Value of Sawdust.

Official Notices and Circulars 580

Foot-and-Mouth Disease—Report of the Animals Division—Landing of Irish Store Cattle in England.

Miscellaneous Notes 582

Bredon Pig Club—Small Holdings and Allotments Societies in 1910—Production of Sulphate of Ammonia.

Importation Regulations 586

Importation of Grain and Seeds into the United States—Importation of Live Stock into Australia—Importation of Live Stock into South Africa—Importation of Feeding Stuffs into Sweden.

Agricultural Exhibitions Abroad 587

International Horticultural Exhibition at St. Petersburg in 1913.

Notes on Agriculture Abroad 587

Admission of Articles into Belgium for the Ghent Exhibition—Statistics of the Dairy Industry of Canada—State Grants to Live Stock Shows in Uruguay—Development of Agriculture in Hungary—Statistics of Agricultural Labour in Sweden—Agricultural Activity in Greece—Cost of Producing Crops in Canada—Live Stock Industry in Holland—Cultivation of Sunflower Seed in Russia—The Norwegian Dairy Industry—Hop Growing in Italy for Breweries—Budget of the Danish Ministry of Agriculture—Production of Nitrate in Chile—Agricultural Machinery in Siberia.

Notes on the Weather in September 594

Acreage of Hops 594

Agricultural Conditions in England and Wales on October 1st 595

Notes on Crop Prospects Abroad 596

Report of the International Agricultural Institute—Germany—Hungary—Holland—Spain—Russia—United States—Australia—Hops.

Prevalence of Animal Diseases on the Continent 599

Agricultural Labour in England during September 600

The Corn Markets in September. *C. Kains-Jackson* 601

The Live and Dead Meat Trade in September. *A. T. Matthews* ... 604

The Provision Trade in September. *Hedley Stevens* 606

Statistical Tables 608

Additions to the Library 614

Any of the above Articles may be reproduced in any registered newspaper or public periodical without special permission, provided that the source is acknowledged in each case.

By Appointment to H.M. The King.

FISONS'

(IPSWICH)

FERTILIZERS

FOR

WHEAT
GRASS
FRUIT
WINTER OATS
BEANS AND BARLEY

The sales of these fertilizers increase every year, and for season 1912 reached an unprecedented total.

Full particulars and prices for large or small quantities sent by return of post.

JOSEPH FISON & CO., Ltd, IPSWICH

LIME

FOR THE LAND.

Nature's Fertiliser

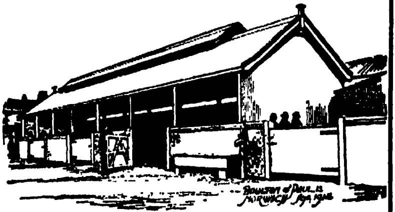
as advised by the

Board of Agriculture.

For quotations apply to

THE TOTTERNHOE LIME Co., Ltd.,
21, Great St. Helens,
LONDON, E.C.

COVERED YARDS FOR CATTLE



We Specialise in all kinds of ECONOMICAL STEEL ROOFING for FARMS and ESTATES.

Cart Sheds, Stock Yards, Iron and Wire Fencing, &c.

Drawings and Estimates Free.

Boulton & Paul, Ltd., Norwich

Showrooms: 128, Queen Victoria St., London, E.C.

CONTENTS.

PAGE

Supply of Store Cattle and Slaughter of Young Calves 617

Foot and Mouth Disease. *Professor B. Bang* 624

Tor Grass or False Brome and its Eradication from Down Pastures. *H. P. Hutchinson, B.Sc.* 648

Hydrocyanic Acid from Linseed Cake 657

Purchase and Use of Basic Slag 660

Sugar Beets as Food for Live Stock 664

Susceptibility of Various *Cruciferæ* to Finger-and-Toe Disease 668

Gorse, Furze or Whins as a Forage Crop 670

Summary of Agricultural Experiments 671

Manures for Permanent Pasture—Eradication of Moss—Manuring of Meadow Hay—Probable Error in Pig Feeding Trials—Feeding Value of Wheat Offals (Criblon)—Composition and Feeding Value of Weed Seeds—Feeding Value of Potato Haulm—The Cause of Wide Variation in Milk Production by Dairy Cows.

Notes on Co-operation 679

Pig Insurance Clubs in 1911—Organisation of the Sale of Live Stock in Austria—Proposed Legislation in Holland to enable Agricultural Labourers to Acquire or Rent Land—Reconstitution of the Agricultural Organisation Society.

Official Notices and Circulars 693

Foot-and-Mouth Disease—Loans for the Equipment and Adaptation of Small Holdings.

Agricultural Estates belonging to the Crown 694

Importation Regulations 695

Importation of Plants, Seeds, Manures, etc., into Uruguay—Admission of Hay, Straw and Manure into France—Importation of Potatoes into Canada—Importation of Animals into Sweden—Importation of Live Stock into the Falkland Islands—Importation of Animals into the East Africa Protectorate—Importation of Live Stock into New Zealand.

Notes on Agriculture Abroad 697

Measures for Combating American Gooseberry Mildew in Holland—The Yield of the State Forests of Saxony in 1910.

Notes on the Weather in October 698

Potato Harvest in Lincolnshire and Cambridgeshire 698

Produce of Hops 699

Produce of Corn, Pulse, and Hay Crops 700

Agricultural Conditions in England and Wales on November 1st 701

Notes on Crop Prospects Abroad 702

Report of the International Agricultural Institute—Sugar Beet—Hungary—Hops—Canada.

Prevalence of Animal Diseases on the Continent 704

Agricultural Labour in England during October 705

The Corn Markets in October. *C. Kains-Jackson* 706

The Live and Dead Meat Trade in October. *A. T. Matthews* ... 708

The Provision Trade in October. *Hedley Stevens* 710

Prices of Agricultural Produce 712

Additions to the Library 718

Any of the above Articles may be reproduced in any registered newspaper or public periodical without special permission, provided that the source is acknowledged in each case.

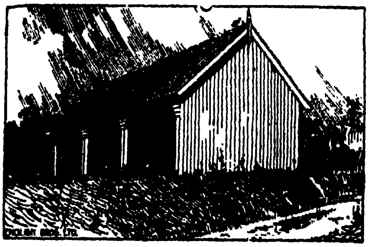
By Appointment to H.M. The King.

FISONS'
(IPSWICH)
FERTILIZERS
FOR
WHEAT
GRASS
FRUIT
WINTER OATS
BEANS AND BARLEY

The sales of these fertilizers increase every year, and for season 1912 reached an unprecedented total.

Full particulars and prices for large or small quantities sent by return of post.

JOSEPH FISON & CO., Ltd, IPSWICH



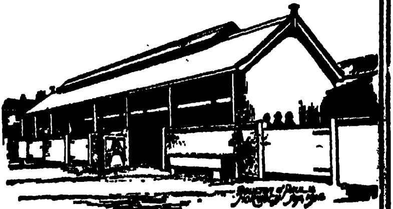
OUR
CREOSOTED WOOD
FARM BUILDINGS, LOOSE BOXES, FIELD SHELTERS
LAST A LIFETIME.
THEY ARE HEALTHY AND ECONOMICAL TO ERECT.
ALSO
CREOSOTED WOOD FENCING & GATES.

Send for our "BUILDING" Catalogue.

ENGLISH TIMBER BOUGHT AND SOLD.

ENGLISH BROS. LTD.
WISBECH and PETERBOROUGH.

COVERED YARDS FOR CATTLE



We Specialise in all kinds of ECONOMICAL STEEL ROOFING for FARMS and ESTATES.

Cart Sheds, Stock Yards, Iron and Wire Fencing, &c.

Drawings and Estimates Free.

Boulton & Paul, Ltd., Norwich

Showrooms: 126, Queen Victoria St., London, E.C.

CONTENTS.

PAGE

CHICKEN REARING ON AN INTENSIVE SYSTEM 721

THE CONTROL OF AGRICULTURAL SEEDS IN SWITZERLAND. *James Long* 726

PARASITIC MANGE IN HORSES, ASSES AND MULES 732

CULTIVATION OF THE TEASEL 738

The Climatic Limits of Wheat Cultivation 742

The Cultivation of Pansies and Violas by Allotment Holders 749

Percentage of Curd in Imported Butter 750

Absorption of Copper Fungicides by Potatoes 751

Control of the Hop Flea-Beetle 753

The Agricultural Output of Ireland 754

Summary of Agricultural Experiments 757

Sickness in Glasshouse Soils—Varieties of Wheat—Varieties of Winter Wheat—Manuring of Swedes and Turnips—Manuring of Runner Beans—Varieties of Clover—Factors affecting the Richness of Cream obtained from Separators—Milk Tests and Records—Yield of Cheese and Losses in Pressing and Ripening—Helianthi as a Food for Dairy Cows—The Germinating Capacity of Seeds of Dodder—Physiological and Fungicidal Effect of Bordeaux Mixture.

Notes on Agricultural Co-operation 763

Co-operative Cow Insurance Societies in 1911—Whissonsett Small Holders' Credit Society.

Official Notices and Circulars 775

Foot-and-Mouth Disease—Regulations for the Show of Thoroughbred Stallions, 1913—International Year Book of Agricultural Legislation—Vacancy for a General Inspector in the Horticultural Branch.

Report of the Development Commissioners 777

Importation Regulations 780

Importation of Nursery Stock, etc., into the United States—Importation of Potatoes into the United States—Importation of Potatoes into Southern Rhodesia.

Notes on Agriculture Abroad 782

International Agricultural Exhibition at Ghent in 1913—Agricultural Exhibition at Auckland, New Zealand, in 1913-14—International Agricultural Exhibition at The Hague in 1913—Free Carriage of Pedigree Live Stock to South Africa.

Notes on the Weather in November 783

Produce of Potato and Root Crops 784

Agricultural Returns for Scotland, 1912 785

Agricultural Conditions during November 786

Notes on Crop Prospects Abroad 787

Report of the International Agricultural Institute—Russia—Prussia—Canada—United States.

Prevalence of Animal Diseases on the Continent 789

Agricultural Labour in England during November 790

THE CORN MARKETS IN NOVEMBER. *C. Kains-Jackson* 792

THE LIVE AND DEAD MEAT TRADE IN NOVEMBER. *A. T. Matthews* ... 795

THE PROVISION TRADE IN NOVEMBER. *Hedley Stevens* 797

Prices of Agricultural Produce 799

Selected Contents of Periodicals 805

Additions to the Library 806

Any of the Articles in this Journal may be reproduced in any registered newspaper or public periodical without special permission, provided that the source is acknowledged in each case.

The Board accept no responsibility for any statements made in the advertisement columns of this Journal.

By Appointment to H.M. The King.

FISONS'

(IPSWICH)

FERTILIZERS

The sales of these fertilizers increase every year, and for season 1912 reached an unprecedented total. The new price list will be ready at the end of December, and it will answer the purpose of every agriculturist to obtain a copy of same before placing his orders for fertilizers for 1913.

Full particulars and prices for large or small quantities sent by return of post.

JOSEPH FISON & CO., Ltd, IPSWICH

LIME

FOR THE LAND.

Nature's Fertiliser

as advised by the

Board of Agriculture.

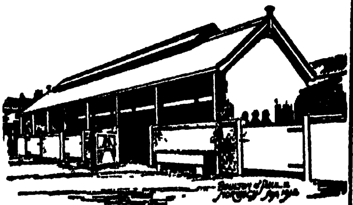
For quotations apply to

THE TOTTERNHOE LIME Co., Ltd.,

21, Great St. Helens,

LONDON, E.C.

COVERED YARDS FOR CATTLE



We Specialise in all kinds of ECONOMICAL STEEL ROOFING for FARMS and ESTATES.

Cart Sheds, Stock Yards, Iron and Wire Fencing, &c.

Drawings and Estimates Free.

Boulton & Paul, Ltd., Norwich

Showrooms: 128, Queen Victoria St., London, E.C.

CONTENTS.

PAGE

PARTIAL STERILISATION OF SOIL FOR GLASS-HOUSE WORK. *E. J. Russell, D.Sc.*, and *F. R. Petherbridge, B.A.* 809

SEED ANALYSES: THEIR INTERPRETATION AND USE. *S. F. Armstrong* .. 827

THE FEEDING OF CATTLE 835

IMPORTS OF AGRICULTURAL PRODUCE IN 1912 838

Agricultural Exports in 1912 845

The Chestnut Bark Disease 848

Provision of Technical Advice in Forestry 850

Destruction of Meadow Saffron 852

Agricultural Labour in the United States 853

Summary of Agricultural Experiments 855

Manuring of Meadow Hay—Peat Moss Litter Manure—Composition and Digestibility of the Ether Extracts of Hays and Fodders—The Iron Content of Milk—Influence of Fatness of Cow at Parturition on the Percentage of Fat in the Milk—Forty Years' Management of Woods—Increasing the Durability of Fence Posts—Effect of Lime on Sorrel ("Sour-dock") in Meadows—The Effects of Road Tarring—Digestion Experiments with Poultry—Poultry Experiments—Egg Laying Competitions—Growth of Fruit and Vegetables—Feeding Sour Milk to Calves as a Remedy for Scouring.

Notes on Agricultural Co-operation 862

Agricultural Co-operative Credit Societies in England and Wales in 1911—Agricultural Co-operation in Belgium in 1910.

Official Notices and Circulars 870

Foot-and-Mouth Disease—Reproduction of Ordnance Maps.

Importation Regulations 871

Importation of Live Stock into South Africa—Importation of Fruit into Western Australia—Importation of Hay and Straw into Australia—Transit of Plants, etc., through Italy.

Notes on Agriculture Abroad 871

The Norwegian Forestry Budget—Prevalence of Animal Diseases in Germany in 1911—Measures for Combating American Gooseberry Mildew and Black Currant Mite in Ireland.

Notes on the Weather in December 873

Produce of Corn, Pulse and Hay Crops in Scotland, 1912 874

Produce of Potato and Root Crops in Scotland, 1912 875

Agricultural Conditions during December 876

Notes on Crop Prospects Abroad 877

Report of the International Agricultural Institute—France—Germany—United States.

Prevalence of Animal Diseases on the Continent 878

Agricultural Labour in England during December 879

THE CORN MARKETS IN DECEMBER. *C. Kains-Jackson* 881

THE LIVE AND DEAD MEAT TRADE IN DECEMBER. *A. T. Matthews* ... 884

THE PROVISION TRADE IN DECEMBER. *Hedley Stevens* 886

Prices of Agricultural Produce 888

Additions to the Library 895

Any of the Articles in this Journal may be reproduced in any registered newspaper or public periodical without special permission, provided that the source is acknowledged in each case.

The Board accept no responsibility for any statements made in the advertisement columns of this Journal.

By Appointment to H.M. The King.

FISONS'
(IPSWICH)
FERTILIZERS

The sales of these fertilizers increase every year, and for season 1912 reached an unprecedented total. The new price list is now ready, and it will answer the purpose of every agriculturist to obtain a copy of same before placing his orders for fertilizers for 1913.

Full particulars and prices for large or small quantities sent by return of post.

JOSEPH FISON & CO., Ltd, IPSWICH

The Canadian Dominion Development Limited, Liverpool.
3, Adelaide Street, Strand, W.C.

FRUIT FARMING IN BRITISH COLUMBIA COMBINES PROFIT WITH PLEASURE

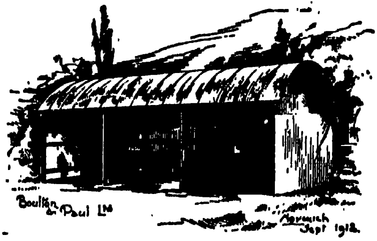
The finest fruit in Canada, is produced in the Kootenay district of British Columbia. With a magnificent climate and virgin soil and with excellent arrangements for transport to an inexhaustible market close at hand,

SPLENDID OPPORTUNITIES

are afforded to those who are willing to devote their energies to this healthy outdoor life, amidst ideal surroundings.
Our Orchard Lands adjoin the beautiful Arrow Lake, and are for sale at reasonable prices, payable within four years.
If you wish for full information concerning the Fruit Growing Industry of B.C. and the large returns obtainable—Write for FREE Illustrated Booklet.

CANADIAN DOMINION DEVELOPMENT, LTD. (OF LIVERPOOL),
DEPT. J.A., 3, ADELAIDE STREET, STRAND, LONDON, W.C.

STEEL-FRAMED SHEDS
— for —
STOCK, CARTS OR IMPLEMENTS.



We specialize in all kinds of economical Steel Roofing for Farms and Estates.

ESTIMATES FREE ON REQUEST. DESIGNS SUBMITTED TO SUIT ANY REQUIREMENTS.

GALVANIZED WIRE NETTING.
IRON AND WIRE FENCING.
FIELD HURDLES, TREE GUARDS, Etc.

Write for Catalogues.

BOULTON & PAUL Ltd.
Engineers, NORWICH.
Showrooms: 128, Queen Victoria Street, London, E.C.

CONTENTS.

PAGE

AGRICULTURAL CO-OPERATIVE CREDIT SOCIETIES AND JOINT STOCK BANKS 897

CHICKEN REARING ON AN INTENSIVE SYSTEM 902

BRITISH GROWN TOBACCO. *Rupert Ellis* 904

EXPERIMENTAL WORK IN ARTIFICIAL INCUBATION. *W. Brown* 909

THE APHIDES ON MANGOLDS AND ALLIED PLANTS. *F. V. Theobald, M.A., F.E.S.* 914

THE PRODUCTION OF CLEAN MILK ON TWO LARGE DAIRY FARMS *Home Counties* 923

Clover Sickness 928

Quality of Farm Seeds 930

The Supply of Qualified Veterinary Surgeons for the Public Services ... 931

Marram Grass for Paper Making 935

Summary of Agricultural Experiments 936
Effect of Manures on the Herbage of Grass Land—Survey of the Soils and Agriculture of Shropshire—Manuring of Mangolds—Varieties of Wheat and Barley—Growth of Sugar Beet—Seeds Mixtures for Permanent Pastures—Cultivation of Lavender—Breeding Experiments with Welsh Mountain Ewes—Weight of Shorthorn Calves at Birth—Fattening Bullocks—Some Factors Affecting the Bacteriological Content of Milk—Experimental Forestry in Wales—Protection of Young Spruce from Frost.

Notes on Agricultural Co-operation 944
The Management of a Pig Club—Wem Cow Club—Co-operative Credit in India—The Zemstvo Credit Banks of Russia—Co-operative Cattle and Horse Insurance in Austria.

Official Notices and Circulars 952
Foot-and-Mouth Disease—Recent Leaflets—Destruction of Wood Pigeons—Enquiry into the Food of Birds—Tenth International Congress of Agriculture—Weekly Return of Market Prices—Colonial and Foreign Statistics, 1911.

Improvement of Mountain and Moorland Breeds of Ponies 955

Manual Instruction in Rural Elementary Schools 957

Importation Regulations 958
Importation of Lucerne and Forage Plant Seed into Argentina—Importation of Cattle into Australia—Importation of Animals into the Straits Settlements.

Notes on Agriculture Abroad 959
State Aid to Agriculture in Austria—Forestry Congress at Paris in 1913—Adriatic Exhibition in Vienna in 1913—International Horticultural Exhibition at St. Petersburg—Cost of Harvesting in France.

Notes on the Weather in January 962

Agricultural Conditions in England and Wales during January 962

Notes on Crop Prospects Abroad 963
Report of the International Agricultural Institute—Sugar Beet—Norway—Italy—India—Russia—France—Hops—Meat Supplies at Chicago.

Prevalence of Animal Diseases on the Continent 966

Agricultural Labour in England during January 967

THE CORN MARKETS IN JANUARY. *C. Kains-Jackson* 968

THE LIVE AND DEAD MEAT TRADE IN JANUARY. *A. T. Matthews* ... 971

THE PROVISION TRADE IN JANUARY. *Hedley Stevens* 973

Prices of Agricultural Produce 975

Selected Contents of Periodicals 981

Additions to the Library 982

Any of the Articles in this Journal may be reproduced in any registered newspaper or public periodical without special permission, provided that the source is acknowledged in each case.

The Board accept no responsibility for any statements made in the advertisement columns of this Journal.

By Appointment to H.M. The King.

CHAMPIONSHIP OF THE WORLD FIVE TIMES FOR

BARLEY

Obtained with

FISONS'

(IPSWICH)

FERTILIZERS

Large stocks of Extra Quality Barley Fertilizer and Special Fertilizers for Oats, Grass, etc., are now ready in perfect condition for immediate delivery. New price list and full particulars on application.

JOSEPH FISON & CO., Ltd, IPSWICH

The Canadian Dominion Development Limited, Liverpool

3, Adelaide Street, Strand, LONDON, W.C.
& 357, Royal Liver Building, LIVERPOOL.

An Orchard in

BRITISH COLUMBIA

provides a self-supporting and income-producing home.

We are an English Company concerned with the colonisation of our own fruit lands, adjoining the beautiful Arrow Lake. In referring to this famous district, the Chief of the Dominion Fruit Division, at Ottawa, stated:—

"*The soil and climate are wonderful, unequalled anywhere else in Canada.*"

FREE BOOKLET

"Fruit Ranching in B.C."

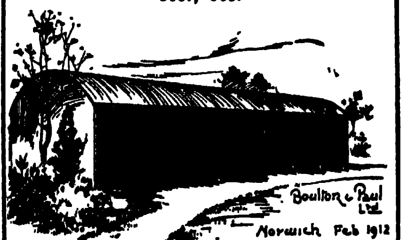
is obtainable on application, and contains the fullest information concerning this industry, the price of land—the large returns obtainable, the magnificent climate, soil, scenery, sport, &c.

CANADIAN DOMINION DEVELOPMENT LTD.
DEPT. J.A., 3, ADELAIDE STREET, STRAND, LONDON, W.C.,
OR 357, ROYAL LIVER BUILDING, LIVERPOOL.

STEEL-FRAMED SHEDS

— for —

HAY OR GRAIN STORES,
CART or IMPLEMENT SHEDS,
etc., etc.



No. 160 Shed. Constructed entirely of steel framing, and covered with galvanized corrugated iron sheeting. Size 90 ft. x 30 ft. and 13 ft. high. Can be erected complete in 32 days.

Estimates free on request. Designs submitted to suit any requirements.

Write for Catalogues.

BOULTON & PAUL Ltd.

Engineers, NORWICH.

CONTENTS.

PAGE

Cultivation of Tobacco for the Preparation of Fruit and Hop Washes 985

Lime-Sulphur Wash for American Gooseberry Mildew. *E. S. Salmon, F.L.S.*, and *C. W. B. Wright* 994

"Yellow Rattle" as a Weed on Arable Land. *Winifred E. Brenchley, D.Sc., F.L.S.* 1005

Insurance against Damage to Crops by Hailstorms 1009

Farm Schools in France, Germany and Belgium 1014

Report on Grants for Agricultural Education and Research, 1911-12 ... 1016

"White-Heads" or "Take-All" of Wheat and Oats 1020

Scheme for Agricultural Research and Technical Advice for Farmers .. 1025

Agricultural Holdings Act, 1913 1028

Summary of Agricultural Experiments 1029

Varieties of Wheat—Experiments with Potatoes—Varieties of Barley—Varieties of Oats—Milk Records—The Bacteriology of Cheddar Cheese—Utility Poultry Club's Twelve Months' Laying Competition—Poultry Experiments—Eradication of Wild Radish in Serradella—Some Factors influencing the Efficiency of Bordeaux Mixture.

Notes on Agricultural Co-operation 1035

Prees Cottagers' Cow Club—Welland High Bridge Pig Club, Spalding—Agricultural Credit Banks in France in 1911.

Official Notices and Circulars 1039

Foot-and-Mouth Disease—Hay and Straw used for Packing—Animals (Landing from Ireland) Order of 1913—Regulations as to the Growth of Tobacco for Nicotine Extraction—Circular Letter as to Tuberculosis—Special Research Grants—Damage to Oats by Frit Fly—Acreage and Live Stock Returns of 1912—Hop Growing on the Pacific Coast of America.

Duration of Buildings, &c., required for Small Holdings 1047

Changes in the Number and Size of Agricultural Holdings 1049

Importation Regulations 1050

Importation of Plants into Australia—Importation of Hay, Straw and Peatmoss into the Isle of Man—Export of Live Stock to South Africa—Importation of Plants into Nyasaland—Importation of Cattle into British Columbia—Importation of Animals into Sweden—Importation of Potatoes into Argentina—Importation of Dogs into the Sudan.

Notes on Agriculture Abroad 1052

Wheat from the East Africa Protectorate—Agricultural Exhibition at Prague—Promotion of Agriculture by Private Effort in the United States and Canada.

The Weather in England During February 1053

Agricultural Conditions in England and Wales during February 1054

Notes on Crop Prospects Abroad 1055

Report of the International Agricultural Institute—Sugar Beet—Live Stock in Germany—Live Stock in Hungary—Live Stock in the United States—Russia—Tasmania—Canada—Spain.

Prevalence of Animal Diseases on the Continent 1056

Agricultural Labour in England during February 1057

The Corn Markets in February. *C. Kains-Jackson* 1058

The Live and Dead Meat Trade in February. *A. T. Matthews* ... 1061

The Provision Trade in February. *Hedley Stevens* 1063

Prices of Agricultural Produce 1065

Additions to the Library 107

(*Title-Page and Index to Vol. XIX.*)

Any of the Articles in this Journal may be reproduced in any registered newspaper or public periodical without special permission, provided that the source is acknowledged in each case.

The Board accept no responsibility for any statements made in the advertisement columns of this Journal.

By Appointment to H.M. The King.

FOR

QUALITY

AND

QUANTITY

USE

FISONS'

(IPSWICH)

FERTILIZERS

A pamphlet containing full particulars of 33 brands and lowest quotations sent on application. Carriage paid any station 2 ton lots.

JOSEPH FISON & CO., Ltd, IPSWICH

The Canadian Dominion Development Limited.

Head Office, Liverpool.

3, Adelaide Street, Strand, LONDON, W.C.

Splendid openings in

BRITISH COLUMBIA

where **Fruit Growing** combines

PROFIT with **PLEASURE.**

We are now offering in small lots some of the finest orchard land in the famous Kootenay district of British Columbia, at £16 to £20 per acre, payable within 4 years.

Magnificent climate and alluvial soil. Excellent transportation and markets. Shooting (big and small-game), fishing, &c.

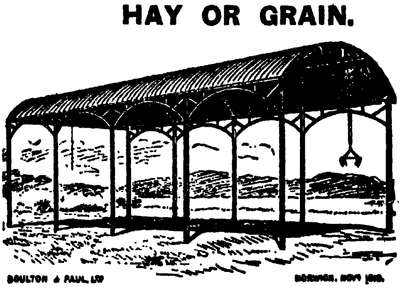
For FREE illustrated booklet on "Fruit Ranching in B.C.," and full particulars, apply

CANADIAN DOMINION DEVELOPMENT LTD.
(*Head Office: Liverpool.*)
DEPT. J.A., 3, ADELAIDE STREET, STRAND, LONDON, W.C.

STEEL FRAMED

DUTCH BARNS

HAY OR GRAIN.



These permanent Sheds are now superseding thatch. Once erected they last a lifetime, and save money.

For strength and utility our barns are unequalled, and as we hold large stocks of material, we are able to give prompt delivery.

DESIGNS and ESTIMATES FREE.

We specialise in

STEEL ROOFING of all kinds for FARMS and ESTATES, CARTSHEDS, CATTLE SHELTERS, STOCKYARDS, etc., etc.

Write for Catalogues.

BOULTON & PAUL, LTD.,

Engineers, NORWICH.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE

Vol. XIX. No. 1.

APRIL, 1912.

GRANT FROM THE DEVELOPMENT FUND IN RESPECT OF PROVISION OF TECHNICAL ADVICE IN FORESTRY.

The Board of Agriculture and Fisheries have been informed that the Lords Commissioners of his Majesty's Treasury, on the recommendation of the Development Commissioners, have sanctioned the payment from the Development Fund of a sum of £2,500 per annum for three years to be distributed by the Board as Grants to certain Institutions in England and Wales to enable them to supply technical advice to landowners and others interested in forestry.

Owing to inadequate resources, Institutions possessing Forestry Departments have hitherto restricted their attention for the most part to imparting instruction to students. It is now proposed to attach an experienced forest expert to the Forestry Departments of two Universities and three Colleges, whose chief duty will be to supply to landowners and others advice as to the general and detailed working of their woods. Each Institution will therefore become, for a given district, a centre for information, to which application may be made on all questions relating to the formation, treatment, utilisation, and protection of woods.

It is essential that the staff to be employed in advisory work should command the confidence of landowners. The men selected should, therefore, be well acquainted with the practice and theory of forestry both at home and abroad. They should be prepared to study in detail the local conditions in their districts, and they must endeavour to impress the advantages of systematic management on those owners of woodlands with whom they come in contact.

In order to provide the data which are necessary for the foundation of efficient forest management, the Board propose, with the co-operation of landowners, to establish a number of experimental plots dealing with the thinning, underplanting, and regeneration of woods. It will be one of the duties of the forest experts to be appointed by means of the Grant to aid the Board's officers in the selection, treatment, and supervision of these plots, and in the collection of such statistics as may, from time to time, be required.

Conditions of Grant.

1. A grant of £500 per annum for three years from October 1st, 1912, will be made to each of five Institutions to provide the salary and travelling expenses of an advisory expert.

2. The grant in each case will be a grant-in-aid only. It must be used for the purpose of developing advisory work, and must not be used for the purpose of reducing existing expenditure.

3. It will be open to an Institution to employ a member of the present staff on advisory work, but in that case his place must be filled by a fresh appointment to the teaching staff.

4. The Board will require to be satisfied that the officers whom it is proposed to employ on advisory work possess the necessary qualifications. Where advice of minor importance is sought the case may be investigated by a junior officer, but in all cases the advisory officer must be responsible for the advice tendered.

5. Advisory officers may undertake a limited amount of teaching on condition that other members of the staff give an approximately equivalent time to advisory work.

6. The advisory staff will be expected to co-operate with the Board's officers both in experimental work and in the making of inquiries.

7. Each Institution in receipt of a grant from this fund will be expected to undertake the advisory work in a group of counties.

8. An Institution may, where this course appears to be desirable, charge a fee in respect of advice tendered under the Scheme. The charge may not exceed one guinea per day for each day's work in the field.

9. The advisory officer must supply to the Board a duplicate copy of the reports sent to persons seeking advice, or where verbal advice only is given a short statement of the case and of the advice given should be sent.

SUPPLY OF STORE AND DAIRY CATTLE.

ALFRED MANSELL.

THE question of the supply of suitable store cattle for the requirements of the feeder is of paramount importance at present. Its consideration is necessarily connected, however, with the enormous growth of the dairy industry, brought about by the annually increasing demand for dairy products.

The various breeds and crossbreeds all have their advantages and adaptability to certain districts, but the same general requirements must be fulfilled, such as early maturity, soundness and vigour of constitution, and economical production of meat of prime quality. These can only be secured by careful selection in type and conformation and the avoidance of breeding from scrubs, either on the side of the dam or sire.

Breeding and Feeding for Beef Production.—Speaking generally, the beef market now requires a medium-sized early maturing animal of the short-legged, blocky type, and well developed in all the best parts. Not only must the breeding be such as to produce this class of animal at maturity, but the calf must maintain a continuous growth from the time of its birth, and its development must not be retarded by withholding, even for a short period, an adequate supply of food to promote a healthy and vigorous body.

In rearing store cattle, whether for sale or ultimately disposing of as beef, everything should be done to keep on the calf flesh, to promote a healthy and vigorous growth and sound constitution, and this can only be secured by a liberal supply of food under such conditions as will promote a full growth of hair, which enables them to withstand the inclement weather usually prevailing in the early months of the year.

Cattle reared in this way may be described as thrifty, and are always keenly sought after.

The aim should be to rear the calves in as natural a way as possible, and in the case of heifer calves intended to go into the dairy, it is a great mistake to get them fat; they should run in open yards, have plenty of exercise, regular feeding, and to promote the dairy qualities they should be allowed to calve at about two-years old rather than later.

If once a young animal is allowed to sink in condition, no amount of subsequent high feeding will bring it back to the same thrifty state, and it will never develop the same depth of flesh; on the contrary, if put on liberal rations, it will become fatty, and lack the nicely marbled meat which it should be the aim of every feeder to secure.

In the past, large cattle, three to four years old, were readily disposed of for killing, but the public taste now prefers young juicy meat, which can only be obtained from well-bred animals which have been liberally treated from birth, and are fit for the butcher at from 20 to 24 months old.

Use of the Calves from Dairy Cattle as "Stores."—Recognising that to produce first-class beef the foregoing conditions must prevail, it is a matter of surprise that a great many indifferent store cattle are placed on the market which, when fattened, can only compete with even inferior imported beef, and must leave very unsatisfactory results to the feeder.

The reason, which is obvious to anyone interested, is that a large proportion of these stores are the offspring of dairy cattle by scrub bulls, the breeder's primary consideration being to secure a new milch cow.

These miserable calves are usually sold at birth, are reared very badly, and taking into consideration their parentage and early treatment, can never be expected to develop into vigorous and thrifty cattle.

Necessity for Good Sires.—Again, many of our small farmers, who may or may not be sellers of dairy produce, cannot afford to buy a good bull, and they have to resort to inferior animals to enable them to continue their breeding operations.

Much has been said of late about the somewhat wholesale slaughter of calves, but I cannot think this prevails to any large extent where a good bull has been systematically used. In most cases where good sires have been continuously used, even on dairy cattle, the breeder has had no trouble in finding a customer at good prices for his calves for rearing purposes.

It is not reasonable to expect that a market can be found for mongrels out of herds in which the custom has been to use any class of sire to secure pregnant cows.

There seems to be a general impression that it is impossible to secure a suitable bull for a dairy herd, which could beget bull calves (to be steered), which will make good beef cattle. I cannot subscribe to this notion, as it surely cannot be necessary to eliminate in dairy-bred bulls, good conformation, wealth of flesh, and other desirable points likely to produce good feeding cattle.

A method of encouraging the use of good bulls which has been adopted by the Flint and Denbigh Hunt may be mentioned. A bull is purchased by the Hunt Committee, and a stud fee of 1*s.* per cow is paid to the farmer in charge, who also receives 5*s.* per week for the keep of the bull during about 24 weeks of the season. During the sixteen years of the existence of this scheme, 16,230 cows have been received, and in the opinion of those best able to judge, this use of good bulls has raised the value of the stock by from £2 to £3 per head, or, at a moderate computation, it has added a capital value of £35,000 in stock to the wealth of the district.

Mr. Robert Bruce, of the Royal Dublin Agricultural Society, also speaks in high terms of the results achieved in the improvement of cattle in Ireland by a somewhat similar scheme initiated by the Royal Dublin Society, and latterly carried on by the Irish Department of Agriculture. A certain sum, say £15, is paid by way of premium for a bull selected by a farmer for his own and his neighbours' use, if such bull fulfilled certain requirements as to pedigree, &c.

The premium may be extended for a second or even a third year, if the bull proves to be a desirable and fruitful sire.

In non-dairying districts a scheme of this kind should prove of great assistance in raising the general standard of quality of the cattle.

Value of Milk Records.—I am glad to note that a movement is on foot towards a more universal adoption of milk records.

This movement has my heartiest approval, as I am convinced that in a large number of cases very unprofitable cows are kept in many dairies. If a farmer can increase his yield per cow by only 100 gallons per annum, it means a considerable addition to his income, and greatly adds to the capital value of the herd.

To know with certainty which cows are profitable, and which heifers should be kept to add to the herd from time to time, it is absolutely essential that a milk record should be kept.

For all practical purposes it would suffice to weigh (rather than measure) each cow's milk once a week, and it would be a splendid education for a farmer's son to see this properly carried out.

It is also important to test the quality of the milk as regards butter fat, because it does not necessarily follow that the cow which gives the most milk is the one most profitable to the farmer. The necessary apparatus is not costly, and any farmer who cares to take the trouble can easily carry out the test.

When this is efficiently performed, a farmer is able to weed out the non-paying cows, and gradually build up a herd of good paying animals, and from these profitable cows he should be able to sell his bulls at good prices to dairy farmers.

In an admirable paper read before the Glasgow Agricultural Discussion Society in 1908 by the late Mr. John Speir, who was without doubt a great authority, it was stated that in the Gaupen Milk Record Society of 12 herds, each pound of butter produced during the first year of its existence cost 8*d.* per lb. for food alone, whilst then (1908) it was produced for 4½*d.* and 4¾*d.* It was also claimed that milk records enabled the breeder who read them aright to increase his profits in two ways:—

(*a*) By increasing production;
(*b*) By decreasing his expenses.

Mr. Speir quoted the following authentic cases:—

(1) When the late Mr. Tisdale, of Holland Park, began farming, he bought 12 of the best heifers he could find, and bred from the best of these and their produce for 25 years, during which period each cow's milk was regularly weighed. His average for the best 12 heifers in his possession during his occupancy of Holland Park was as follows: For the first year, 450 gallons; for the tenth year, 600 gallons; for the twentieth year, 868 gallons.

(2) Mr. John Evens, Burton, Lincoln, who received the first prize for the best managed farm in the show district of the Royal Agricultural Society in 1908, began to weigh the milk of each cow in March, 1885, and had continued to do so twice daily ever since. In 1890 and 1891 the average number of cows in milk was 33, which gave an average yield of 729 gallons for these years. In 1904 and 1905 he had an average of 48 cows which gave 828 gallons, while the 33 best cows in 1905 gave an average of 923½ gallons.

(3) The first society to keep milk records on a co-operative basis was that of Vejen. The average yield per cow for 12 herds for the first two years was 670 gallons, and the average for the eighth year was 730 gallons—an increase of 60 gallons per cow all round. This, at 8*d.* per gallon, would be an increased return of 40*s.* per cow. Some of the herds, however, gave very much greater increases, viz., from 477 gallons to 880 gallons, and from 574 gallons to 836 gallons.

(4) A farmer in Sweden, who prided himself on having an extraordinarily good milking herd, joined one of the milk-record associations in 1897, and during his first year his herd of 70 gave an average of 800 gallons of milk. He sold off 42 of his worst milking cows and kept 28 of the very best, which he mated with a bull out of a known heavy-milking cow. In 1905 he had again a herd of 72 milking cows, all descended from these 28 selected animals, which gave an average of 1,220 gallons in that year. (5) One society in South Sweden, that of Vallakra, where Ayrshires were in great request, increased its average yield per cow from 670 gallons of milk during the first year to 876 gallons in its sixth year. During the first year of its existence the average percentage of fat in the milk was 3·09, whilst in its sixth year

the average increased to 3·21 per cent. of fat, notwithstanding the fact that the quantity of milk was 31 per cent. greater than it was six years previously.

(6) From 1898 to 1903 Dr. Woll, of the Agricultural College of Wisconsin, caused every separate article of food which was given to each of the 35 to 38 cows in the college herd during that period to be weighed. The milk was also weighed and analysed. The herd was composed of selected specimens of each of the three or four principal dairy breeds. The results showed that, while one cow yielded butter of the annual value of £20, after payment had been made for all her food, the yield of butter from the others dropped gradually till one actually produced £1 less value in butter than had been the cost of food alone consumed by her during that year. In the other two years during which the cow was tested, she gave a small profit. These experiments conclusively proved that pedigree was of far greater importance than food in the production of milk or butter.

Breeding for Dairying Purposes.—The dairyman's aim should be to secure a good roomy class of Shorthorn or Shorthorn Cross cow with size, flesh, and milk, in contradistinction to the cow having a tendency to grow fat and lumpy, with a poor udder and doubtful breeding qualities.

One of the greatest troubles the dairy farmer (who gives thought to his business) has is to obtain a bull from a cow with a good milking record, and the keeping of milk records would help in this direction.

A great danger to the country, which must have disastrous results in the near future, is the wastage of our very best dairy cows through their finding their way to our populous towns, and being eventually sent to the butcher when their yield of milk fails to prove remunerative to the owner. This system means an annual slaughter of a large number of our best dairy cattle, and great efforts should be made to stem, if not entirely to put an end to, this wholesale sacrifice of these fine animals, which should, if properly mated, reproduce what the nation is most in need of. One way to do so would be to lessen the number of town dairymen who do not have their cows bulled, but find it cheaper to milk the cow as long as she is profitable, and then dispose of her as beef to the butcher. This, considered from all points, is a difficult problem, and the question as to what can be done to induce the town dairyman to have his cows bulled is not easy of solution. At the same time, there cannot be any doubt that he should be able to dispose of his calves at good prices, and, moreover, he would not be continually in the market for newly milched cows, for which he frequently pays extravagant prices. I am rather of opinion that if the town dairyman gave it a trial, he would find it not so unprofitable as he seems to think, as his expenditure in providing new milched cows would be much reduced, as he would have a certain number of his best cows periodically returning to profit.

THE FEEDING OF FARM STOCK.

CHARLES CROWTHER, M.A., Ph.D.,
Leeds University.

PART III.—THE COMPOUNDING OF RATIONS.

IN devising rations for stock the following general considerations should be taken into account:—

1. *The ration should be suitable in amount and composition for the particular class of stock to which it is to be fed, and for the particular system of cropping practised on the farm.*

COMPOSITION.—The necessity for a supply of albuminoids in every ration, and the way in which the requirements of different classes of animals for albuminoids vary, have already been discussed. It has also been pointed out that there are reasons, both practical and scientific, why the proportion of albuminoids in the ration should not be unduly high.

The importance of a sufficient supply of albuminoids is so great, however, that the margin of safety must not be made too narrow. Moreover, the fact may be recalled that any excess of albuminoids will be recovered as nitrogenous matter in the urine, and the manure arising from the consumption of the ration will be correspondingly richer, if adequately preserved, than if the bare minimum of albuminoids has been supplied.

In view of the high nutritive value of *oils* or fats, it is obviously desirable to include them in rations as far as is practicable. They are, however, usually expensive to supply, and if consumed too freely are apt to cause digestive disturbance. As a rule, it is hardly desirable to include oil (or fat) in the daily ration to the extent of more than, roughly, 1 lb. per 1,000 lb. live-weight, the only notable exception being the consumption of fat in the form of whole milk by young animals. Where a special addition of oil is made to a ration, this is best given in a finely emulsified form.

The supply of albuminoids and oil being limited by the foregoing considerations, the greater part of the ration must thus consist of carbohydrates and fibre—ingredients which abound in the home-grown foodstuffs, and which are relatively the cheapest ingredients of most purchased foods.

Attention may again be directed to the necessity for an adequate supply of lime and phosphates in the ration (vol. xviii., p. 906). The risk of deficiency is greatest in the case of young stock and milking animals. In most cases the addition of a little salt to the ration, or the placing of a lump of rock-salt within the reach of the animal, is to be commended. The amount must be very small, however, in the case of pigs, or their progress may be seriously checked. Most feeders are, indeed, decidedly averse to giving any salt to pigs, owing to the great risk involved.

AMOUNT.—As regards the weight of food that should be included in the ration, this must be such that, after providing for the general maintenance requirements (vol. xviii., p. 903) and the labour involved in the mastication and digestion of the food, a sufficient surplus of digested nutrients will remain to provide adequately for any productive activities of the animal, such as the production of milk, fattening increase, &c. In other words, the weight of the ration must be such as, in conjunction with its composition, to give it a sufficiently high productive value.

Coarse fibrous foods require far greater labour for their mastication and digestion than do the softer and more concentrated foods, and therefore leave to the animal a correspondingly lower surplus of nutriment available for general nutritive and productive purposes. *The feeding value of a ration is thus not determined solely by its weight and composition, but the character of the constituent foodstuffs must be taken into account.* The larger the proportion of coarse fibrous foodstuffs (hay, straw, &c.) included in the ration the greater will be the total weight of dry matter necessary to meet the requirements of the animal.

The "starch-equivalents" given in the table in vol. xviii., p. 901, have been arrived at by methods in which due allowance is made for the differences in composition and mechanical character of the various foodstuffs, so that they may be taken as a measure of the relative values for fattening or other productive purposes of equal weights of the materials when of the composition stated in the table.

Suggestions as to the weight and composition of rations suitable for different purposes will be found in a later article dealing with the special requirements of different classes of stock.

2. *The ration must be adapted in bulk to the capacity of the digestive organs of the animals for which it is intended.*—If it is too bulky the animals will not be able to consume it steadily day after day, whilst if it is too compact they will not feel satisfied and will therefore not do their best.

The total dry matter of a ration serves as a convenient measure of its bulk apart from any "roots" included in it, and will be used to furnish guidance in this respect in the typical rations quoted later. In "roots" the bulkiness is, of course, due to the large proportion of water they contain.

The bulkiness of a ration is regulated in the main by the proportion of coarse fodder (hay, straw, &c.) and roots included in it, and the available supplies of these foodstuffs will determine whether the standard of total dry matter indicated in the typical ration shall be closely adhered to or not. Deviations up to, say, 10 per cent. from this standard may be accounted as of little importance. With a liberal allowance of roots less hay and straw will be required to give the ration the desired degree of bulkiness than when roots are omitted or supplied only in small quantities.

3. *The foodstuffs included in the ration must all be suitable for the class of stock to which the ration is to be supplied.*

It is well known that certain foods are not suitable for all classes of stock, *e.g.*, undecorticated cotton cake for very young stock. On the other hand, certain foodstuffs have special merits for particular classes of stock. Guidance in these matters will be given later when dealing with the rations for different classes of stock. (See also Leaflet No. 74, pp. 11–22.)

4. *No foodstuff should be included in the ration that may detrimentally affect the quality of the finished product aimed at.* Such effects arise mainly from the character of the oils (or fats) in the foodstuff. These have a tendency to impress their character upon the body-fat or milk-fat to an extent which, although slight, is sufficient in many cases to affect seriously the commercial value of the product. Further, certain foods are apt to communicate undesirable flavours to the product, *e.g.*, turnip flavour in milk. The point is one which crops up most frequently in connection with the feeding of cows and pigs.

5. *The ration must be palatable and acceptable to the stock.* This condition is essential if the digestive and assimilatory functions of the animal are to be stimulated to their maximum efficiency. In general the animal that eats most heartily thrives best. Palatability is more easily and certainly assured if a variety of foodstuffs be blended together for the purposes of the ration, than if only two or three foodstuffs are used. This practice, moreover, has further advantages in that it ensures that all the various nutrients shall be suitably represented, and the work of digestion thereby well distributed over the various sections of the digestive apparatus, whilst it also reduces any risk that may arise from the imperfection of some ingredient of the ration. (See also Albuminoids, Leaflet No. 74, p. 3.)

The addition of a little salt or of some agreeably flavoured foodstuff, such as treacle or locust beans, or judicious preparation of the food by cooking or otherwise, will usually remedy any deficiencies of flavour, and it is only in exceptional cases that any recourse to "spices" is warranted.

Calculation of Rations in Practice.

In the practical compounding of rations which will satisfy the foregoing requirements and will be similar in composition to the typical rations given later, the following procedure may be followed:—

1st. Taking into account the supplies available and market prices, decide what quantities of home-grown produce (hay, straw, roots, grain) can be allowed for each animal per day, and regulate the allowance accordingly, provided that the quantities are not so great as to make the ration too bulky. The completeness or otherwise with which this portion of the ration is consumed will furnish evidence as to whether the quantities require further adjustment or not.

2nd. Decide what special foods—if any—and what amount of each it is desirable to include in the ration in order to secure certain beneficial effects, *e.g.*, locust beans or treacle, to make the ration more appetising; undecorticated cotton cake to correct any excessive laxative tendency of other ingredients of the ration; bran to assist the action of the bowels.

3rd. Calculate the amounts of dry matter and digestible albuminoids present in the ration as constructed thus far, and its starch-equivalent. If there is reason to suspect a serious excess or deficiency of oil, this should also be calculated.

When analyses of the actual materials employed are available these should, of course, be used for the calculation. (For digestibility, see table in Leaflet No. 74, p. 7.) Such analyses are, however, rarely available except in the case of some purchased concentrated foods, so that we must usually be content to base our calculations upon the average composition of each food, as obtained from a table such as that in vol. xviii., p. 901. It should be remembered that the composition of the foodstuffs actually used may differ widely from these averages, so that there is little point in aiming at a high degree of precision in the calculations. It will not be worth while going beyond the first or, at most, the second place of decimals.

The requirements that the ration should fulfil are not completely defined by its content of dry matter and digestible albuminoids and its starch-equivalent, but if satisfactory in these respects, it will, as a rule, be satisfactory so far as other aspects of its composition are concerned.

4th. Compare the totals for the ration thus far compounded with those of the standard ration given for the class of stock for which the ration is intended (see Part IV., to follow). Then, if there be any deficiency, find out by comparison of the compositions and market prices (see Leaflet No. 74) what concentrated foodstuff or mixture of foodstuffs will be most economical to use in order to bring the ration up to the stated requirements.

5th. If much oil-cake or other foodstuff rich in oil is included, note specially that the total supply of oil should not appreciably exceed 1 lb. of digestible oil per 1,000 lb. live-weight per day, for any but very young growing animals. On the other hand, it is desirable for most purposes that the amount of digestible oil should not fall much below about ¼ lb. per 1,000 lb. live-weight per day.

The great advantage of working out a ration in this way is that one ascertains the amount of trough food required. This will always include the chief albuminoid food, which is at the same time the most expensive, and the one to be purchased unless peas or beans are grown on the farm. The concentrated foods should be accurately weighed at the commencement; afterwards they may be measured by means of a marked bucket. In actual practice the roots and hay, after the first day or two, might be guessed at, and the straw would probably be given less carefully than the hay, especially at the night foddering, in order to satisfy the appetite of the more hearty animals; any straw remaining in the morning would be drawn back as litter.

The procedure outlined above is illustrated by the following examples:—

EXAMPLE 1.—*To construct a winter ration for a milk cow weighing* 9 *cwt. and giving about two gallons* (20 *lb.*) *of milk per day.*

We will assume that the available supplies on the farm permit of a daily allowance of 28 lb. swedes, 7 lb. meadow hay, and 7 lb. oat straw.

	Dry Matter.	Digestible True Albuminoids.	Starch Equivalent.
	lb.	lb.	lb.
28 lb. Swedes supply	3·2	0·08	1·96
7 ,, Meadow Hay ,,	6·0	0·28	2·17
7 ,, Oat Straw ,,	6·0	0·07	1·33
28 ,, Brewers' Grains ,,	7·0	1·12	4·20
Totals	22·2	1·55	9·66
Or, say	22	1·5	9·6
Standard requirements* are ...	27	1·8	10·5
Hence deficit to be made good by concentrated foods	5	0·3	0·9

---

* These will be given in a subsequent article.

We will assume further that wet brewers' grains are to be obtained cheaply, and it is decided therefore to give 28 lb. per day.

Then, using the data for these foods in the table in vol. xviii., p. 901, we get the figures in the table on the last page.

In deciding what foodstuffs shall be used to complete the ration, attention may be directed mainly to the deficiencies in albuminoids and starch-equivalent. These are ·3 lb. and ·9 lb. respectively, or in the proportion of 1 : 3. The ration may therefore be completed satisfactorily by means of any foodstuff (or mixture) supplying digestible true albuminoids and starch-equivalent in approximately this proportion, provided only that it is suitable for milch cows. Such foodstuffs are linseed cake, undecorticated cotton cake, malt coombs, or bean meal—all excellent foods for milch cows. Thus:—

	Dry Matter.	Digestible Albuminoids.	Starch Equivalent.
	lb.	lb.	lb.
1¼ lb. Linseed Cake supply	1·1	0·31	0·95
2 ,, Egyptian Cotton Cake ,,	1·8	0·31	0·80
2½ ,, Malt Coombs ,,	2·2	0·29	1·00
1½ ,, Bean Meal ,,	1·3	0·29	1·00

The deficit in dry matter is not quite made good, but this is of little consequence, and could be easily remedied if desired by slightly increasing the allowance of straw.

It is commonly preferable to use a mixture of concentrated foodstuffs to complete the ration rather than to rely upon one single foodstuff. There are then far greater possibilities in the selection of the foodstuffs, and considerable economies can often be effected. Thus any of the above-named foodstuffs might be mixed together in the proportions mentioned, or other mixtures might be made up of foods with narrower and others with wider albuminoid ratios than these. It is only essential that the foodstuffs used shall be suitable, and that the mixture shall supply digestible true albuminoids and starch-equivalent in the proportion 1 : 3. For example, the deficiency might be made up with any of the following mixtures:—

(*a*) 1¼ lb. of a mixture of 2 parts soy bean cake with 1 part maize meal.
(*b*) 1¼ ,, ,, equal parts soy bean cake and cocoanut cake.
(*c*) 1¾ ,, ,, 1 part decorticated cotton cake with 2 parts bran.
(*d*) 1¼ ,, ,, 5 parts decorticated cotton cake with 4 parts crushed oats.

The number of foodstuffs included is not necessarily limited to two, and more may be blended together if a cheaper mixture of the requisite composition can thereby be obtained.

The complete ration is thus:—

28 lb.	Swedes
7 ,,	Meadow Hay
7 ,,	Oat Straw
28 ,,	Wet Brewers' Grains

together with such weight of a suitable foodstuff or mixture of foodstuffs as will supply not less than ·3 lb. of digestible true albuminoids and ·9 lb. starch-equivalent, as in the examples given above.

EXAMPLE 2.—*To construct a daily ration for a farm horse, weighing* 11 *cwt., at average work.*

We will suppose that it is decided to give home-grown foods as follows:—12 lb. hay, 5 lb. oat straw, and 6 lb. oats. Then, from the table, vol. xviii., p. 901:—

		Dry Matter.	Digestible True Albuminoids.	Starch Equivalent.
		lb.	lb.	lb.
12 lb. Hay	supply	10·3	0·48	3·72
5 ,, Oat Straw	,,	4·3	0·05	0·95
6 ,, Oats	,,	5·2	0·54	3·78
Totals		19·8	1·07	8·45
Or, say		20	1·1	8·5
"Standard" requirements* are . .		30	1·7	14·5
Hence deficiency to be made up ...		.10	0·6	6·0

* These will be given in a subsequent article.

The additional food required must thus supply ·6 lb. of digestible albuminoids, and 6 lb. starch-equivalent, *i.e.*, it must supply these two in the ratio 1 : 10. This can readily be attained with any of the following mixtures of suitable foods:—

(*a*) 7½ lb. of a mixture of 1 part of beans with 9 parts of maize or barley.
(*b*) 8 ,, ,, ,, 1 ,, bran and 4 parts maize or barley.
(*c*) 8 ,, ,, ,, 1 ,, beans, 4½ parts maize, and 1½ parts treacle.
(*d*) 8½ ,, ,, ,, 1 ,, dried grains, 3 parts maize, and 1 part treacle.

Or if the allowance of oats can be increased by 4 lb., the ration can then be satisfactorily completed by the addition of 4 lb. of maize or 4½ lb. of barley.

The warning must again be given that, in the present state of scientific knowledge concerning the food-requirements of farm animals, it is impossible to regard even the best methods of compounding rations as more than roughly approximate. Moreover, there are such great individual variations amongst animals of the same class that it would be absurd to assume that one ration would serve all equally well. The rations arrived at in the manner explained in the foregoing pages will serve for a start, but it must be left to the observation and experience of the feeder, supplemented by periodical weighings of the animals or other tests of their progress, to determine whether the rations are proving satisfactory or not, and to make such adjustment as may appear desirable.

PONDS IN AGRICULTURAL DISTRICTS.

EDWARD A. MARTIN, F.G.S.

THE lengthy drought of the summer of 1911 has brought into prominence the lack which has been felt in many districts of an adequate means of water-storage. The majority of farms are far removed from the possibility of utilising the services of a water company, and even where it is possible to utilise company water for the needs of the farmstead, the farm lands attached must always be dependent on ponds or pumping, and in times of drought the latter means frequently fail. Water-storage, therefore, demands the serious attention of the agriculturist, and greater attention to the upkeep of existing ponds is necessary.

Care Necessary in Cleaning Ponds.—At times, when the water in ponds is low, farmers often take advantage of the opportunity to clean them out. If this is done carelessly, or with the object of utilising the pond-mud for manure, much harm may be done to the bed of the pond. Ponds, when once made, last for so long a time that they seem to be natural and permanent. They thus come to be neglected, and when the cleaning process takes place, the method on which the bottom was laid is forgotten. The rich puddle is removed, and the pond-depression ceases to hold water. This, then, is the primary error which must be guarded against, especially in sandy or limestone districts. Where the soil is clay, the pond will probably puddle itself again in the course of time, but to save any delay the old plan of driving cattle or dragging a broad-wheeled cart through it will help rapidly to puddle the clay. Where the puddle is thin, as on chalk or sandy sub-soils, it is dangerous to remove any of it.

Dew-ponds.—Rainfall is, generally speaking, greater on higher ground than on lower ground. Ever since Gilbert White's time writers have frequently referred to the early drying-up of lowland ponds as compared with those on high ground. These remarks are particularly applicable to hilly districts within the influence of sea-breezes and sea-mists, since the mists in the summer come to help the deficiency of rainfall, and thus we have those ponds on the higher ground which have come to be known, no doubt erroneously, as "dew-ponds."

These ponds, which are really rain-and-mist-ponds, are made on the highest ground, and frequently have no drainage except from their own banks, which are somewhat extensive. On the other hand, they are sometimes found by the side of a road or track, and receive the drainage therefrom. Their position is quite different from that of lowland ponds, which are found, as a rule, in the lowest corners of fields, or at the side of a dip in the road. Many of them may, indeed, be natural ponds, having in the course of centuries puddled their own bottoms. But ponds on the high downs of Sussex, Kent, Surrey, Wilts, Hants, or Berks, where the subsoil is chalk, require artificial puddling, since, except in times of occasional torrential rains, the chalk soaks up practically all the water at once.

Making of Ponds on Chalk Soils.—In the course of my experiments * on dew-ponds, I have found no less than ten different methods of making a waterproof bottom. The principal constituent is puddled clay or chalk. The former is the more easily made, but there is usually greater cost in obtaining and carting the clay. Suitable chalk is, as a rule, near at hand, although the labour of pounding and puddling may be greater. Some lime should be mixed with the puddle to keep out the "red-worm." Most of the ponds on the chalk are chalk-puddled, and although this cakes and cracks when the pond dries up, the first rain following expands the dry puddle and again makes it water-tight. The removal of this dry puddle must be carefully guarded against. Where rushes, &c., have pushed their roots through the puddle it is necessary to remove them, as these may in the end drain away the water, but floating pond-weed and grasses round the edge, if not too old, may be left, since these undoubtedly collect a certain amount of dew in the summer months. In the same way, a tree overhanging the pond, or the banks, is useful in collecting dew. The tree is of most advantage when it is on that side of the pond which is most exposed to the prevailing wet winds.

---

* "Dew Ponds," *Knowledge*, May and June, 1907; *South-Eastern Naturalist*, 1908, 1910; *The Geographical Journal*, Aug., 1909, and Oct., 1910.

Use of Straw with Clay.—A layer of straw is sometimes placed under the clay, and sometimes above it. If placed above the clay it prevents the clay cracking in the course of making, since the ponds are usually made in dry weather. Upon this are placed stones or broken chalk, as a means of preventing perforation of the clay-bottom by the pointed hoofs of sheep. It has been held that when the straw is placed under the clay it assists in the condensation of dew into the pond, by enabling the water, or the dry puddled bank, to become considerably lowered in temperature. My own experiments have not borne out this theory, and it was extremely seldom that the water or bank ever touched dew-point. On the other hand, there is the disadvantage of having a movable foundation of straw while the puddle is being laid down. The weight of the clay also presses the straw into a thin layer, and this disintegrates in a few years, so that whatever virtue there may have been in the non-conducting qualities of the straw at the commencement must very rapidly be lost. There is no real necessity for straw to be used at all, except as a temporary precaution against cracking during the progress of the making.

Cemented Bottoms for Ponds.—Cemented ponds or concreted ponds are a constant source of trouble. They look well at the commencement, but show signs of cracking very rapidly, and require constant repair. A well-made puddled pond will outlive many cemented or concreted ones.

Cleaning Ponds.—Both upland and lowland ponds are too frequently allowed to foul. This cannot altogether be prevented, but a good deal might be done in the way of removing droppings from cattle. Water-weed assists materially in purifying the water, as it gives off a quantity of oxygen. Newts and pond-snails do no harm.

Very few farms are adequately supplied with sufficient ponds for all needs, and this is especially true where they are used to supply traction and ploughing engines. Spare labour in the early spring might well be utilised for the excavation of ponds.

WEEDS IN RELATION TO SOILS.

WINIFRED E. BRENCHLEY, D.SC., F.L.S.

Rothamsted Experimental Station.

IN an earlier number of this *Journal* * an account was given of an investigation carried out in 1910 on the relations existing between the weeds and soils of arable land in South Bedfordshire, the results of which indicated the necessity of extending the work in order to obtain further definite information. Consequently in 1911 a similar examination was made of the weed flora of certain districts in Wiltshire and Somersetshire, the work being on exactly similar lines to that of the previous season. The chalk of the Wiltshire Downs, in the neighbourhood of Shrewton, provided a comparison with the Bedfordshire Downs, while the district round Bath is characterised by a heavy clay, which is in direct contrast to the Oxford clay of the eastern county in that it is very calcareous in nature, a fact which is reflected in the flora.

During the season's survey 106 species of weeds were met with, representing 74 genera. Of these, 29 species, representative of 26 genera, were each seen once only. As in the previous investigation, attention was confined to those weeds growing among the crops, the weeds of the surrounding hedgerows being left out of consideration. The classification of the soils did not present the same difficulty as in the case of the Bedfordshire work. The areas dealt with were much larger, and adjoining fields did not show the sudden change in the nature of the soil that occurred so frequently in the eastern county. The presence or absence of lime in the soil was frequently ascertained by means of tests with dilute hydrochloric acid.

---

* W. E. Brenchley, "Weeds in Relation to Soils," *Journ. Bd. Agric.*, xviii., No. 1.

The seasons in the two years of investigation were of totally different character, that of 1910 being wet and cold, with a deficiency of sunshine, while that of 1911 was characterised by an excessive amount of sunshine and by high temperatures, coupled with a low rainfall, so that conditions of drought prevailed. This radical difference may have influenced the relative occurrence of certain species, so that it is quite probable that some of the diversity of results may be due to seasonal variation rather than to the actual differences in the nature of the soil. The data obtained have been classified and analysed so as to indicate the distribution of the various weeds on the different soils. Certain weeds are so exceedingly rare on some soils that they are classed as absent.

A. *Clay and Heavy, Brashy Soils.*—The soils described as *clay* are very fine in texture, being composed essentially of a large proportion of tiny particles of silt bound together by a small proportion of true clay, silicate of alumina, which is most adhesive in nature. The finely grained texture causes such soils to be most retentive of water, and they hold a large percentage under ordinary conditions. This tends to make the clays somewhat heavy and cold; there is also a danger of water-logging, as superfluous water drains away with difficulty. Water-logged soils are peculiarly harmful to plant life, on account of the deficiency of air in their interspaces. Unless the under-drainage of clay soils is very efficient, so that the effect of these disadvantageous conditions is minimised, the number of species of plants found upon them is somewhat restricted, as all plants which are at all impatient of excessive soil moisture are lacking, leaving the field clear for those which are less exacting in their demands. The flora on the clays, however, is not very sharply marked out, as there are so many gradations from heavy clay down to heavy loams and thence to lighter loams.

In the districts round Inglescombe and Inglesbatch, near

Bath, the land is of an exceptionally heavy nature, being a very sticky clay, which needs special care and methods to farm it properly. During the hot weather it bakes very badly and opens out into deep cracks. This soil is chiefly derived from the Fuller's earth (appearing as a very tenacious yellow clay), and from deposits of clay and limestone. The latter gives the soil its calcareous nature, a factor which proves to be of great importance in determining the flora. The number of species occurring was relatively less than on chalky soils, and the majority of the plants were such as occurred on any type of soil, hardly one appearing to be symptomatic of clay. A very few species, however, were chiefly associated with clay, though occurring on other types of soil as well, and one, Hoary Plantain (*Plantago media*), appears to be confined to clay in this district. Shepherd's Purse (*Capsella Bursa-Pastoris*), Wild Mint (*Mentha arvensis*), Annual Meadow-grass (*Poa annua*), Corn Buttercup (*Ranunculus arvensis*), and Coltsfoot (*Tussilago Farfara*) were chiefly associated with clay, though they were also seen on other soils. A few others which were very prominent on the clay proved to be equally abundant on chalk, the chief of these being Charlock (*Brassica alba*), Dwarf Spurge (*Euphorbia exigua*), Greater Plantain (*Plantago major*), Knotweed (*Polygonum Aviculare*), Black Bindweed (*Polygonum Convolvulus*), and Silverweed (*Potentilla anserina*). In this last group, it is probably the large amount of lime in the soil which determines the presence of these particular weeds.

B. *Chalk*.—The type of vegetation found upon chalky soils, especially on chalk downs, is very distinctive. Chalk, besides being of such a decidedly alkaline nature, provides a substratum of a peculiar type, and naturally one would expect to see this reflected in the flora. The flora of the Wiltshire Downs is similar in many respects to that of the Bedfordshire Downs except that a larger range of species occurs. Indeed, the noticeable feature of the weed flora in Wiltshire is the large number of species occurring, many species being essentially characteristic or even symptomatic of chalk. In both these respects the flora is in marked contrast to that of the clay. The Field Brome (*Bromus arvensis*), Barren Brome (*Bromus sterilis*), Corn Campanula (*Campanula hybrida*), Carrot

(*Daucus Carota*), Round-leaved and ordinary Toadflax (*Linaria spuria* and *L. vulgaris*), Corn Cockle (*Lychnis Githago*), Field Forget-me-not (*Myosotis arvensis*), Smooth-stalked Meadow-grass (*Poa pratensis*), and Wild Mignonette (*Reseda lutea*) are all confined to chalky soil and are symptomatic of it. Various other plants are very characteristic of the chalk but are occasionally seen on other soils as well. The chief of these are Hardhead (*Centaurea nigra*), Hogweed (*Heracleum Sphondylium*), Field Poppy (*Papaver Rhoeas*), Ribwort Plantain (*Plantago lanceolata*), Field Scabious (*Scabiosa arvensis*), Shepherd's Needle (*Scandix Pecten*), Field Madder (*Sherardia arvensis*) and Wild Pansy (*Viola tricolor*).

The special association of such plants as Ribwort Plantain, Field Poppy, and Hardhead with chalky soils in this district is noteworthy, as these plants are usually quite general in distribution and not more characteristic of one type of soil than of another.

The Shepherd's Needle is a most characteristic feature on the Wiltshire chalk, especially on the heavier red land lying towards the top of the Downs. In some instances this weed is dominant, being present in very great abundance.

C. Bake.—This is a thin layer of soil lying on the top of the Downs which is noteworthy in that it is destitute of lime, and is instead sandy and acid in nature. Consequently the few species of plants that are found in any quantity in this situation are those typical of light acid soils. Spurrey, Sheep's Sorrel, Annual Knawel (*Scleranthus annuus*), the unfailing indicators of acid conditions of soil, were all in evidence, associated with a certain amount of Charlock (*Brassica Sinapis*) and Poor Man's Weather-glass (*Anagallis arvensis*).

Although as a general rule species proved to be associated with similar soils in Bedfordshire and Wiltshire, yet isolated instances of divergence occurred. The Scarlet Pimpernel (*Anagallis arvensis*) and Fat Hen (*Chenopodium album*) are absent from the chalk soils in Bedfordshire, so much so that they were regarded as lime-haters. In Wiltshire, Fat Hen is recorded more frequently from chalk than from any other habitat, whilst the Pimpernel is everywhere found on the chalk (in addition to other localities), although only very small quantities of it appear in such situations. Red Bartsia (*Bartsia Odontites*), also, which is prominent on clay and lacking on the chalk in Bedfordshire is practically absent from clay and is very frequent on chalk in the West.

The most familiar weeds, which were universal in distribution in the eastern county proved to be similarly universal in the West, such plants as Creeping Thistle, Chickweed, Sow Thistle, Mouse-ear Chickweed, Groundsel, and Cleavers being ubiquitous.

Points of Special Interest.—(1) Except in a very few instances, it was again found that the type of crop grown is practically a matter of indifference in determining the species of weeds occurring, when compared with the influence exerted by the nature of the soil.

A few weeds were only associated with *Cereal* crops, as Corn Campanula, Henbit (*Lamium amplexicaule*), Nipplewort (*Lapsana communis*), Rough-stalked Meadow-grass (*Poa trivialis*), Cinquefoil (*Potentilla reptans*), and Corn Buttercup, while a few others were similarly found only in conjunction with *Leguminous* crops—Thyme-leaved Sandwort (*Arenaria serpyllifolia*), Mouse-ear Chickweed, various species of wild Geranium, and Field Madder.

On the contrary, a few species were always *lacking* among leguminous crops, though they occurred among all other types. The chief of these were Onion Couch (*Arrhenatherum avenaceum* var. *bulbosum*), Hogweed, Rye Grass (*Lolium perenne*), Wild Mint, Hoary Plantain, Annual Meadow-grass, Couch, and Ivy-leaved Speedwell (*Veronica hederaefolia*).

(2) Couch or Twitch.—Only two species seem to be designated as such in the West (a) *Triticum repens,* the true couch, (b) *Arrhenatherum avenaceum* var. *bulbosum,* "Onion Couch" or "Knotty Couch." The latter is one of the worst of weeds when it occurs in any quantity, as it easily spreads and is most difficult to eradicate on account of its swollen tuberous stems, each joint of which will develop into an independent plant if detached.

(3) Equisetum and Coltsfoot.—These did not occur in company so frequently as they did in Bedfordshire. The Coltsfoot was more often associated with clay soils, but as before, the

distribution of both weeds was general. It has been suggested that the presence of Coltsfoot is an indication of the nearness of underground water and that the plants can only thrive if they can send down their long roots to tap it; this theory, however, needs confirmation.

(4) Yellow Rattle (*Rhinanthus Crista-Galli*) was very prevalent in some places in the West. Generally this is a weed of pasture land, but in one case observed, on a chalk soil, the barley crop was full of it and was utterly ruined by it. Some seasons are far more favourable to the growth of this weed than others, though in both 1911 and 1912 large quantities have occurred in this particular district.

(5) The total absence of Mayweed (*Matricaria inodora*) was very noticeable. A small amount of *Anthemis* sp. occurred in places, but the plants rarely attained any size, and so a very conspicuous feature in the weed flora of Bedfordshire was missing in that of the West Country, on similar soils.

Summary.—The results of the investigations in the two districts may be conveniently summarised as follows:—

1. Many of the differences between the two floras are simply differences in quantity, which change the balance of the distribution of the weeds on the different types of soil.

2. Several plants which occur on various soils in Bedfordshire are definitely associated only with chalk soils in the West Country.

3. Other plants which appear as calcifuges in Bedfordshire are more or less frequently observed on chalk in the West.

4. A few weeds are recorded from each district which are totally absent from the other. The number of such species, however, is far less than might have been expected, considering the distance between the two localities, involving some difference in climate and in soil.

A table is given on p. 26 which shows the distribution of some of the most abundant or characteristic weeds in the West Country districts investigated. A line ——— indicates absence.

		Clay and Heavy Brash.	Chalk.	Bake.
Anagallis arvensis	Scarlet Pimpernel	Frequent	Frequent	Abundant
Anthemis sp.	Mayweed	Frequent	Occasional	—
Bartsia Odontites	Red Bartsia	Occasional	Frequent	—
Brassica alba	Charlock	Frequent	Frequent	—
,, *Sinapis*	Charlock	Very general	Very general	Sometimes abundant
Campanula hybrida	Corn Campanula	—	Symptomatic	—
Capsella Bursa-pastoris	Shepherd's Purse	Frequent	—	—
Carduus arvensis	Creeping Thistle	Very frequent	Very frequent	Occasional
Centaurea nigra	Hardhead	Occasional	Characteristic	—
Chenopodium album	Fat Hen	Very frequent	Very frequent	—
Convolvulus arvensis	Bindweed	Very frequent	Very frequent	—
Daucus Carota	Carrot	—	Symptomatic	—
Equisetum arvense	Horsetail	Occasional	Occasional	—
Euphorbia exigua	Dwarf Spurge	Frequent	Frequent	—
Fumaria officinalis	Fumitory	Occasional	Very frequent	—
Galium Aparine	Cleavers	Very frequent	Very frequent	—
Linaria vulgaris	Toadflax	—	Symptomatic	—
Lithospermum arvense	Corn Gromwell	Occasional	Characteristic	—
Mentha arvensis	Wild Mint	Frequent	Occasional	—
Myosotis arvensis	Field Forget-me-not	—	Symptomatic	—
Papaver Rhoeas	Poppy	Very occasional	Characteristic	—
Plantago major	Greater Plantain	Frequent	Frequent	—
,, *media*	Hoary Plantain	Very characteristic	—	—
Polygonum Aviculare	Knotweed	Very frequent	Very frequent	—
,, *Convolvulus*	Black Bindweed	Very frequent	Very frequent	—
Ranunculus acris	Buttercup	Frequent	—	—
,, *arvensis*	Corn Buttercup	Occasional	Rare	—
,, *repens*	Creeping Buttercup	Fairly frequent	Frequent	—
Rumex Acetosella	Sheep's Sorrel	—	—	Symptomatic
,, *crispus*	Curled Dock	Frequent	Very frequent	—
Scabiosa arvensis	Field Scabious	Very occasional	Very characteristic	—
Scandix Pecten	Shepherd's Needle	Very occasional	Very characteristic	Scarce
Senecio vulgaris	Groundsel	Fairly frequent	Fairly frequent	—
Silene Cucubalus	Bladder Campion	Occasional	Very frequent	—
Sonchus arvensis	Sow Thistle	Very frequent	Very frequent	—
Spergula arvensis	Spurrey	—	—	Scarce, but symptomatic
Stellaria media	Chickweed	Very frequent	Very frequent	—
Tussilago Farfara	Coltsfoot	Frequent	Occasional	—
Veronica agrestis	Procumbent Speedwell	Frequent	Frequent	—
Viola tricolor	Wild Pansy	Very occasional	Characteristic	—

THE PEA MOTH (*ENDOPISA NIGRICANA* STPH.).

R. STEWART MACDOUGALL, M.A., D.SC.

THIS moth appears in the literature under a number of names, the generic names being *Grapholitha, Tortrix, Laspeyresia,* and *Endopisa,* while the specific names are *nigricana, pisana, nebritana,* and *proximana.* The Pea Moth is well known in Central and in South Europe. It is found over Britain to Perthshire, and also in Ireland.

The caterpillars of the moth are the cause of the so-called worm-eaten peas. The moth is a widely distributed one, and the damage done is frequently great; yet the references to this insect, in the economic literature, are comparatively rare. In 1911, from different parishes in England—some of them noted for their pea-growing—complaints came to the Board of Agriculture regarding loss due to the ravages of the caterpillar. One correspondent wrote that while "peas without grubs were selling at 110 shillings a quarter, similar peas infested by the caterpillar fetched only 85 shillings a quarter." An interesting point in the communication was that, during the past summer, whereas most of the samples grown on land that carries peas once in 10 years or so were infested, there was not the slightest trace of the insect on land, somewhat remote from other pea-growing fields, in which it was known that peas had not been grown for 80 years.

Another correspondent noting the damage wrote that "a seriously damaged crop is only worth about one-half to three-quarters the price of an undamaged crop."

The moths fly at the time of flowering of the pea; the caterpillars live in the pods and when full-fed leave the pods and creep a little way into the soil. The caterpillar is destructive to both field and garden peas. One or two other leguminous plants have been named as possible host plants, the seed in each case being sought while still forming in the pod.

Description of Insect: Adult.—The fore-wings of the moth are dark-brown or black, and have a metallic sheen or gloss; at the front margin of the fore-wings short white streaks or spots may be seen; there is a very faint eye-like mark towards the apex of each fore-wing, this mark containing within it small black streaks; near the hind margin, about the middle of the wing, is a curved white streak; fringes to the wing resemble the ground-colour. The hind wings are pale-brown or bronzy brown, with white fringes. The under-side of all four wings is pale and with a leaden gloss. The antennæ are black-brown. The moth measures ⅕ inch in length, and from ½ inch to ⅝ inch in spread of wings.

Larva.—The caterpillar is 16-footed, and measures ⅓ inch when full-fed. The colour is a very pale green or yellowish-white; the head is brown or blackish, and lobed; on the upper surface of the joint behind the head is a dark horny plate; the segments of the body have a number of dark dots or warts, each of which carries a bristle-like hair.

Life History.—The moths are found flying in June and July (some may be found in flight in August). The Continental text-books write of the flight taking place soon after sunset. Barrett, on the other hand, writes of the moth as "found in plenty sometimes along the hedges bordering a field which has produced a crop of peas in the preceding year," and as "loving to sit in the bright sunshine on oak and other bushes, flying away with extraordinary swiftness if disturbed to revel in the sunshine in another bush," and he adds, "as it seems to be on the wing throughout the day there seems no reason to suppose that it flies also at dusk."

The females lay their eggs on the young pea-pods. The same female may lay "1 or 2 or 3" eggs on a pod. The caterpillar on hatching eats through the pod in order to reach its normal food, *i.e.*, the seed or pea. The tiny entrance-hole heals up so that externally the pod may appear quite undamaged, while inside the peas are being attacked by the caterpillar.

Some peas are gnawed, others more or less destroyed. Caterpillars may be found at work from July onwards. The caterpillar, on attaining its full size, leaves the pod and passes a little way into the soil, where it spins a web round itself and so passes the winter. In the next spring pupation takes place, and the adults appear in due course.

Taschenberg states that infested pods ripen earlier than those not infested, and open slightly so that the full-grown caterpillars can creep or press themselves out. The caterpillar may eat its way out of the pod.

Correspondents sometimes confuse the work of this caterpillar with the destructive work of the larva of the Pea Beetle, described in Leaflet No. 150. The following distinctions may prevent confusion:—

Caterpillar of Pea Moth.	Grub of Pea Beetle.
Caterpillar has sixteen legs.	Grub legless.
Pupation in soil.	Pupation in pea.
The peas are irregularly gnawed externally.	The peas are eaten internally.
The attacked peas are often woven together by silk threads, and there is a marked granular excrement.	There is no sign of spun threads and the hollowed peas appear clean, without external excrement.

A closely allied species, known as *Grapholitha* or *Laspeyresia dorsana,* is rarer in Britain. It is found in the North of England, and in Scotland has been taken as far north as Inverness. Its caterpillar is longer than that of *E. nigricana,* and is orange-yellow in colour. On the Continent it appears as a pest on peas, with a life-history resembling that of *E. nigricana.*

In Britain wild species of *Lathyrus* have been named as host plants.

Preventive and Remedial Measures.—The time when this pest of the pea can be most advantageously fought is when the caterpillar is in the soil for its winter rest. Where possible a thorough raking or deep hoeing of the soil as soon as it is free from peas would turn up and destroy many of the caterpillars. A field attack should be followed by deep ploughing before winter.

The collection and burning of infested pods, and the firming of the soil at the foot of the plants to hinder the entrance of the caterpillars have also been recommended. When peas are "shelled" for culinary use all larvæ found should be destroyed.

Growth of Linseed for Feeding Purposes.

There is probably no concentrated food so popular and highly valued for all kinds of stock as linseed, either in the natural state, or in the form of cake, and for many purposes it is difficult, if not almost impossible, to replace it by any foodstuff commonly available. In recent years, however, the price has been almost prohibitive, and when, as at present, good fine linseed is selling for over £22 a ton at Liverpool, it is clear that its use must be restricted. As, however, other feeding stuffs are correspondingly dear, many farmers are quite naturally asking if it would not be possible to grow linseed more cheaply than it can be bought, and as the Board have received several inquiries on this point quite recently, a few notes on the cultivation of the crop may be useful.

The Flax or Linseed plant has been grown from very remote times in Europe, India, and Egypt on account of the valuable fibre, flax, obtained from its stem. Within quite recent times it was extensively cultivated for this purpose in both England and Scotland, and it is only within the last few years that it has been given up as a field crop in Great Britain. It is, of course, still a very important crop in the North of Ireland. The chief cause of its decline in Britain was the difficulty of obtaining the large amount of labour necessary at harvest time to pull the flax, and to carry out subsequent operations at a particularly busy time of the year, and in no way the unsuitability of climate or soil for the crop. Probably many parts of this country are as well suited for it as any other part of the world. When the crop is grown for seed alone the labour involved is just about the same as with an ordinary corn crop. In a particularly wet climate such as that which prevails on parts of the west coast, the flax is apt to become laid, and a considerable proportion of the seed may be lost in harvesting. Pheasants and other birds are very fond of the seed, and where the crop is to be tried a piece of ground should be selected well away from danger of damage by such agents.

A certain amount of linseed is obtained where the crop is grown for the fibre, but, as a rule, attempts to obtain both flax and seed give inferior results for both, and generally the cultivation for seed is distinct from the cultivation for fibre. For instance, in Ulster the crop is usually pulled before the seed bolls mature.

Generally speaking, a medium soil, clean and in good condition, is best suited for the crop. Flax takes the place of a corn crop in the rotation, and so, coming after roots or clover, direct manuring ought to be unnecessary. If the soil is too rich, particularly in a moist climate, the crop will become badly laid, and the yield of seed will be unsatisfactory. Flax must not be sown on the same ground too frequently. The rotations adopted in flax-growing districts vary considerably, but on an average flax does not occupy the same land more than once in about seven years. Sowing may take place as soon as the risk of serious frost is past, and in this country April is the most suitable month, the exact time varying a little according to the district and season. In order to get the seed well and evenly covered, a fine tilth is absolutely necessary. Particular attention should be paid to the seed. Linseed, like many other seeds rich in oil, is apt to "heat" if stored in bulk for any length of time, and in order to avoid disappointment the germination of the seed should be tested before sowing; only plump, well matured seed should be used. When sown for flax production about 100 lb. of seed per acre are used, but for linseed it is desirable to sow more thinly, in order to allow the plants to branch freely and to bear a maximum number of flowers and seed bolls. The quantity will vary according to the state of tilth and the germination of the seed, but, assuming that both are perfect, probably 70 or 80 lb. of seed per acre will be ample.

The seed may either be drilled or sown broadcast; if the latter plan is to be adopted the best method on a medium soil would probably be to roll the land with a Cambridge roller, broadcast the seed evenly—not an easy operation owing to the small size and slippery character of the seeds—and cover with a light harrowing followed by another rolling; if desired, the second rolling can be given when the plants are two or three inches high. In any case the seed must not be buried too deeply; some say it should not be more than half an inch, others an inch, below the surface. When grown for flax the crop is carefully hand-weeded, but where seed-production is aimed at it will hardly pay to give much more than the hoeing or spudding usual in the case of corn crops. It is, however, easily smothered by weeds, and, furthermore, it is difficult to separate many weed seeds from the linseed, so that it should not be grown on land at all foul or likely to grow much charlock, spurrey, or other annual weeds.

Reaping of the crop should take place when the straw is ripe and yellow, and the majority of the "bolls" or seed capsules are formed and the oldest of them are ripe and dry. The bolls do not all form at one time, but, as in the case of peas or beans, the same plant will have some flowers just opening while others have set seed. Generally speaking, the crop is ready for cutting about four months after sowing, but this depends a good deal on the season and the richness of the ground. The seed, like that of some corn crops, will fill and ripen in the stook to a certain extent, and as it is easily shed, reaping should preferably take place a few days before the crop is really ripe. The crop may be cut with a binder, reaper, or scythe, and stooked like corn. As soon as it is thoroughly dry it should be carted, and either thrashed out at once or stacked. When carting it is advisable to put sheets on the carts to catch shed seed.

Thrashing can be done quite well with an ordinary thrashing machine if a little care is taken in obtaining the right distance between the drum and the concave.

The crop obtained naturally varies a good deal according to soil and other conditions. In some tests carried out at several centres in North Wales in 1910, in spite of the fact that at practically every place the crop lodged, yields of over 10 cwt. per acre were obtained at three places, and at one centre 16 cwt. of seed per acre were obtained. At only one place, where it was spoiled by bad weather, could the crop be described as a failure. In 1911, in spite of the severe drought, a yield of 10 cwt. of seed per acre was obtained in Essex. Probably under good average conditions at least two quarters of seed, *i.e.*, 832 lb., may reasonably be expected, and in addition to the seed about one and a half tons of straw per acre will be obtained.

The flax plant suffers from various diseases, the most serious of which are "Flax-wilt" (*Fusarium lini,* Bolley) and Flax rust (*Melampsora lini,* Tul). Most of the diseases, however, are only likely to prove serious where flax is grown on a large scale or on the same ground too frequently. Formerly, samples of flax seed were apt to contain also the seeds of a parasitic plant—"flax dodder" (*Cuscuta Epilinum*). If care is exercised in selecting seed there is little fear of this doing much damage, as the seeds are easily separated from flax seed.

In conclusion, it may be safely said that at the present price of linseed the crop is worth a trial for home use, even if not for commercial purposes; care should, however, be taken to obtain good seed, to sow on clean land in good, but not too high, condition, and preferably in a district of moderate rainfall.

Cultivation of Soy Beans in Britain.

The Soy Bean (*Glycine hispida*) is a native of Eastern Asia and has been cultivated for a very long period in China and Japan, in which countries it is the most important leguminous plant grown. It is there used extensively as a food, not so much for stock as for human consumption, its high content of protein and oil making it particularly valuable as a supplement to starchy foods such as rice. The beans are prepared for food in several different ways, and also very often the oil is extracted, the cake left after extraction being used as manure. Both the beans and the cake have been well tried in the last two or three years in this country as food for stock, and it is unnecessary to go into details with regard to their value. It may, however, be mentioned that the beans contain on an average about 16 per cent. of oil and about 40 per cent. of albuminoids. Being a leguminous crop, like clover or ordinary beans, the soy bean plant obtains practically all its food material, including nitrogen, from the air, and so, in spite of the fact that it contains an immense amount of food, is regarded as a renovating crop rather than an exhausting one. Few of our home-grown food stuffs approach it in feeding value, and it is clear that if it could be grown successfully in this country it would soon find a place in ordinary farm practice.

Previous to 1909 a few attempts to grow the crop had been made, but without any great success; at best, the plants obtained grew up to the flowering stage, but no seed was formed. The Board, thinking it possible that the seeds previously tried might have come from hotter climates and have been of varieties quite unsuited to this country, obtained from an experiment station in North Japan, seed of sixteen varieties of soy bean, along with a small quantity of soil in which the crop had been grown. These were grown in 1909 by Mr. J. Golding at the Midland Agricultural College, and Professor Biffen at Cambridge.

In the autumn of 1909 Mr. Golding reported that the seeds were sown on May 6th, and many of them grew well and vigorously, but none flowered. Even some lifted and placed in a greenhouse refused to do so. The plants were, however, strong and healthy, and the roots were covered with an abundance of large nodules.

At Cambridge, the results were similar—no flowers were formed, even though some of the plants were started early in a frame and set out about the end of May. It is interesting to note that no nodules at all were formed on plants grown in soil not inoculated. Where the Japanese soil had been applied the nodule formation was all that could be desired.

These experiments appeared to suggest that Japanese varieties were not suited for conditions here, so in the following year the Board obtained, through the Seed Crushers' Association, some Manchurian soy beans. One sample had been grown in North Manchuria, the other in the South, and each clearly contained several distinct varieties. These were grown as before by Mr. Golding and Professor Biffen. The former reported that again, though the crop had grown vigorously with abundant formation of root nodules, no seed had matured. At Cambridge the test was more successful, the plants, though not growing very vigorously, flowered about mid-August and ripened a small quantity of seed about the end of September. This seed was sown in April, 1911, but the crop made very little growth, and in spite of the hot season no seed was produced.

These results seem to prove fairly conclusively that none of the varieties of soy bean yet tried can be relied on to produce seed, though in an exceptional season or under specially favourable circumstances a certain amount may be obtained. There are, however, many different varieties of the plant, and it is not impossible, even if not very probable, that some kind suited to conditions in this country may yet be discovered.

Apart from seed-production the plant has, however, a considerable value as a forage crop, and it is quite possible that in some cases it may be found useful for that purpose in this country. It appears to resist drought well, and is largely grown in the United States for the green fodder, which appears to be relished by all kinds of stock. Mr. Golding has supplied the following analyses of the green forage produced by the two varieties of Manchurian bean in 1910.

	Harbin Ore Variety.	Dalny Ore Variety.
Moisture	79·14 per cent.	78·93 per cent.
Crude Ether Extract...	0·75 ,,	0·72 ,,
*Crude Albuminoids ...	3·10 ,,	2·76 ,,
Soluble Carbohydrates	10·13 ,,	10·57 ,,
Indigestible Fibre ...	4·77 ,,	4·56 ,,
Ash	2·11 ,,	2·46 ,,
Containing pure Albuminoids	2·39 ,,	2·22 ,,

These analyses are very similar to that of clover cut green, and probably the value for feeding would be about the same. The growth of the crop is still in the experimental stage, and at present there does not seem much chance of its playing any important part in this country. If, however, it is desired to try it as an experiment, it may be suggested that a medium soil rich in lime, phosphates, and potash, would probably be most suitable. Nitrogen is not so essential provided that the soil is well provided with the organisms necessary to produce the nodules on the roots. Perhaps the best way of securing these is to spread over the plot, before sowing the seed, a little soil in which the crop has already been grown with good nodule formation.

New Varieties of Wheat.

In their last report to the National Association of British and Irish Millers, the home-grown wheat committee state that they have come quite definitely to the conclusion that it is possible to obtain by modern scientific methods a combination in one variety of wheat of good yield, high quality of grain and straw and resistance to rust.

No wheat combining all these desirable qualities has yet been put on the market, but a highly favourable opinion is expressed of two new Cambridge wheats, one of which—Burgoyne's Fife—combines high quality with good yield, and another—Little Joss—combines high yield with rust resistance. It is understood that both these wheats gave good results last season when grown on a large scale at various places in the kingdom. Burgoyne's Fife has been quoted at 2*s*. per quarter above good Canadian varieties. In another matter of technical interest the committee have secured the co-operation of the Royal Agricultural Society, and experiments will be made at Woburn to test the effects of various phosphates on yield and quality.

Damage in Woods due to Squirrels.

For sentimental reasons this destructive little animal is often allowed to increase in such numbers that very serious damage is done to woods, and the Board wish to draw the attention of foresters to the necessity for keeping it in check. The squirrel feeds chiefly on the fruits of forest trees, such as the beech, oak, spruce, and Scots pine, and abundant signs of its activity may often be detected, for example, in a spruce wood by the piles of broken scales and stripped cones lying on the ground. In consequence, natural reproduction may be greatly reduced.

The squirrel also does harm by eating buds (more particularly those of spruce and Scots pine) and biting off twigs. The destruction of the buds in snowy winters may entirely prevent seed from being produced. In plantations and thickets from 1 to 6 ft. high, which are not yet provided with flowering buds, the squirrels bite off the top of the previous year's shoot and the side shoots of the last verticil, the buds of which are also eaten. Very few cones are formed on trees where squirrels have lived during the winter. In the summer also, shoots of various lengths up to 8 in. are bitten off spruce trees, as at this time there are no seeds or buds to eat.

The squirrel may also do great damage by peeling and girdling young trees of larch, Scots pine, silver fir, beech, hornbeam, aspen, willows, and oak. Trees from fifteen to thirty years old suffer most, but woods sixty years old are also attacked. The harm is done between May and July, and chiefly in dry years, to the stem in the crown where the squirrel sits, and is sometimes in rings or spirals, and at other times quite irregular. As it goes down to the sapwood the injured stems may die above the peeled place.*

Professor Fisher recommends reducing the number of squirrels by shooting, and the protection of the pine-marten (*Mustela martes*), which is a great enemy of the squirrel, as a natural remedy.

Hedge End Agricultural Credit Society.

HEDGE END is an agricultural parish in Hampshire, four miles from Southampton, with a population of about 1,200. It contains 1,420 acres of land under crops and grass, and is well situated for fruit-growing, there being seventeen acres under orchards and no less than 345 acres (a third of the arable land) under small fruit, principally strawberries, which are generally ready for the early market, between the Cornish and the Kent fruit crops. It is thus a suitable district for small market-gardeners, and there are 109 holdings of between one and fifty acres, besides a considerable number of allotments of less than one acre each. Some of the land, which a few years ago was under grass and was rented at £1 an acre, is now divided up into small fruit-gardens, costing £2 10*s*. per acre.

These market-gardeners are often in need of small advances of capital to work their holdings; and to meet this need a co-operative agricultural credit society was started in 1896, chiefly at the instance of Mr. Hibberd, a small holder, the Rev. R. E. Payne, the vicar of the parish, and Col. Willan, J.P., who became chairman of the Council. The object of the society was declared to be to assist small cultivators, village tradesmen, and rural labourers of known good character, by the grant of loans at the rate of 6 per cent. interest, or 1½*d*. per week for £5, for purposes which, in the opinion of the committee, were likely to prove productive or profitable. The society adopted a set of rules which had been drawn up by the Agricultural Banks Association, since absorbed by the Agricultural Organisation Society, and became registered under the Friendly Societies Act. At the end of the first year it had enrolled nineteen members, a number which has steadily increased until it is now thirty-five. It includes twenty-five small tenants or market-gardeners, one small owner, a dealer, a schoolmaster, the vicar, and five other well-to-do neighbours, who have joined the society in order to give it their help and encouragement.

---

* Schlich's *Manual of Forestry*, Vol. IV, "Forest Protection" (W. R. Fisher.)

The entrance fee was fixed at 2*s*. 6*d*., and the society offered to take deposits at 3 per cent. interest, and to lend money to its members at 6 per cent. It has hitherto managed to raise all the money it required in deposits at this low rate of interest, and as the whole of the work of the society is done without salary, the working expenses are small. The committee consists of men working their holdings themselves, except the chairman, Mr. Rose, and the treasurer and secretary, the Rev. R. E. Payne, who has associated with him as joint secretary a market-gardener, Mr. Coward. Last year the cost of management amounted only to £1 3*s*. 7*d*., including the rent of the school as a place for meetings and the affiliation fee paid to the Agricultural Organisation Society. As the margin between the rate of interest at which the society was able to borrow, and the rate of interest at which it made loans to its members was considerable, the society has shown a profit on its working in every year since it started. This profit has, according to the rules which govern all these credit societies, been added to a reserve fund, which cannot be divided among the members, and which has gradually increased year by year, until it now amounts to £41 3*s*. 9*d*. This is the property of the society, and they have no interest to pay on it; on the contrary, it brings them in a small amount of interest every year.

In 1899, finding it had more money on deposit than its members wanted out on loan, the society reduced the rate of interest on loans of £25 and upwards from 6 to 5 per cent. Seeing that these societies are meant mainly to facilitate small borrowings by small men, it would perhaps have been better to begin by reducing the rate on small loans instead of on large ones. However, in 1904, when the reserve fund had reached £23 8*s*., the society found itself able to reduce the rate of interest on all loans to 5 per cent. and as the reserve fund continued to mount up, in 1908 it reduced this rate further to 4 per cent. The working of the society still shows an annual profit, which last year amounted to £1 8*s*. 4*d*. At the end of 1911 the society's assets amounted to £197 3*s*. 9*d*., of which £184 were out on loans to members and £12 were in hand or in the bank, and its liabilities were only £156 due to depositors, thus showing an accumulated profit to date of £41 3*s*. 9*d*. which forms the surplus or reserve fund, the property of the society.

The main object of the society is to provide small loans for profitable agricultural purposes. During the sixteen years since it was started, it has granted to its members 162 loans amounting in all to £2,736, and averaging £17. It has made no bad debts, and in only one or two cases has it been necessary to put pressure on the sureties to a loan to get it repaid. In no case have the sureties themselves had to pay. Last year the society made new loans to fifteen members, amounting to £160 14*s*., and averaging about £11 per loan. The smallest loan was £2 and the largest £25. The loans were chiefly made for the purchase of seeds or manure, or for the employment of extra labour; in one case the money was advanced for the purchase of a sprayer for the joint use of the members of the society. Loans are renewed, or the term for repayment extended, when good cause is shown to the satisfaction of the committee, but the society has found it advisable to rule that all loans should be paid when due before a new loan is granted to the borrower, and that when a loan is renewed the sum advanced should be reduced by one-fifth or thereabouts. It has also been decided that a borrower will be accepted as surety only for one loan.

Some time ago the auditors recommended that the surplus profits should be invested as a reserve fund in accordance with the rules, but the general meeting of the members decided that those surplus profits should continue to be used for loans to members, that is, should be treated as part of the working capital at the disposal of the committee. They were probably influenced in coming to this decision by the consideration that, if so used, the surplus funds would earn

Statistics of Hedge End Agricultural Credit Society.

I.

Year.	No. of Members at end of Year.	Loans granted during the year.				Rate of Interest charged on Loans. Per cent. per annum.	Deposits received during the Year. Amount.	Rate of Interest paid on Deposits. Per cent. per annum.	Expenses of Management.			Profit on the Working of the Year.			Remarks.
		No.	Amount.												
			£	s.	d.		£		£	s.	d.	£	s.	d.	
1896	19	11	157	9	0	6%	120	3%	2	6	1	1	3	8	
1897	23	8	134	0	0	6%	5	3%	0	6	0	3	9	7	
1898	25	8	125	0	0	6%	10	3%	0	7	4	3	13	0	
1899	25	8	149	0	0	6%	—	3%	0	18	0	1	4	8	
1900	26	11	196	0	0	6%	10	3%	0	9	6	2	18	9	
1901	28	7	146	10	0	6%	17	3%	0	9	6	3	2	8	
1902	30	13	248	0	0	6%	—	3%	0	6	6	3	11	8	
1903	31	9	190	0	0	6%	8	3%	0	17	1	4	4	0	
1904	33	9	205	0	0	5%	20	3%	0	18	0	3	10	5	
1905	32	7	180	0	0	5%	—	3%	1	11	3	2	10	3	
1906	31	10	210	0	0	5%	40	3%	0	15	0	4	3	8	£73 deposit withdrawn.
1907	31	8	107	0	0	5%	10	3%	1	0	9	2	13	9	£22 ,, ,,
1908	32	11	192	0	0	4%	—	3%	1	6	9	0	14	8	
1909	31	10	141	0	0	4%	—	3%	0	19	7	1	3	7	
1910	34	17	194	0	0	4%	8	3%	1	8	2	1	11	1	£8 ,, ,,
1911	35	15	160	14	0	4%	11	3%	1	3	7	1	8	4	

Statistics of Hedge End Agricultural Credit Society.

II.

Year.	Assets at end of Year.												Liabilities at end of Year.			Total Profit to Date at end of Year.		
	Cash in Hand or at Bank.			Loans due from Members.			Accrued Interest.			Total Assets.			Due to Depositors.			Profit.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	a.	£	s.	d.
1896	4	11	8	115	0	0	1	12	0	121	3	8	120	0	0	1	3	8
1897	18	13	2	109	10	0	1	10	1	129	13	3	125	0	0	4	13	3
1898	57	10	9	84	10	0	1	5	6	143	6	3	135	0	0	8	6	3
1899	38	4	3	105	0	0	1	6	8	144	10	11	135	0	0	9	10	11
1900	0	8	11	154	10	0	2	10	9	157	9	8	145	0	0	12	9	8
1901	45	15	7	130	0	0	1	16	9	177	12	4	162	0	0	15	12	4
1902	0	9	9	178	0	0	2	14	3	181	4	0	162	0	0	19	4	0
1903	15	18	8	175	0	0	2	9	4	193	8	0	170	0	0	23	8	0
1904	44	17	11	170	0	0	2	0	6	216	18	5	190	0	0	26	18	5
1905	37	5	8	180	0	0	2	3	0	219	8	8	190	0	0	29	8	8
1906	3	0	4	185	0	0	2	12	0	190	12	4	157	0	0	33	12	4
1907	52	13	4	127	0	0	1	12	9	181	6	1	145	0	0	36	6	1
1908	8	9	7	172	0	0	1	11	2	182	0	9	145	0	0	37	0	9
1909	39	3	6	143	0	0	1	0	10	183	4	4	145	0	0	38	4	4
1910	9	19	3	173	0	0	1	16	2	184	15	5	145	0	0	39	15	5
1911	12	0	6	183	14	0	1	9	3	197	3	9	156	0	0	41	3	9

interest at the rate of 4 per cent., while if they were placed on deposit in the savings bank they would earn only 2½ per cent. On the other hand, the rules say that any surplus accruing to the society, after payment of the cost of administration, shall be carried to a reserve fund, only to be drawn upon by vote of the general meeting in order to meet exceptional losses, and this rule cannot be carried out unless the reserve fund is kept separate from the ordinary working capital, and is not used by the committee except by special permission of the general meeting of the members. The greater security thus afforded to members and depositors, and the improvement in the credit of the society which would result from following this course, would be well worth the small loss of interest it would entail. If the society were now to deposit its surplus profit of £41 3*s*. 9*d*. as a separate reserve fund in the Post Office Savings Bank, where it would be safer than anywhere else, it would earn, at 2½ per cent., interest amounting to over £1 per annum, almost enough to cover its annual expenses. And so long as the society can continue to borrow about £150 at 3 per cent., as at present, and lend this sum to its members at 4 per cent., it will make a profit on this business of £1 10*s*. per annum, and will still be able to add to its reserve fund. If its members require more money by way of loan, the society could now, with its established credit and substantial reserve fund, probably raise any additional sum required at 4 per cent., and continue lending to its members at 4 per cent., without reducing its annual profit.

This society is one of the oldest in England and Wales, and has by sixteen years of careful management achieved the position of having built up a reserve equal to a fourth of the amount required by its members in loans for their farming operations, and of being able to lend money to its members at the very low rate of 4 per cent. Probably in no other parish in the whole country can small agriculturists obtain loans so readily and so cheaply as can these market-gardeners of Hedge End. This advantage they owe to their having combined their personal credit, and so earned the confidence of their neighbours; to Mr. Foord, of Botleigh Grange, and other friends, who have trusted them with their money at a low rate of interest; to the care exercised by their committee, elected by themselves; and last, but not least, to the trouble voluntarily undertaken, without remuneration, by their joint secretaries, in keeping an accurate account of all loan and deposit transactions.

Agricultural Credit and Co-operation in England and Wales.

I.—*Credit.*—In 1911 there were in England and Wales 435,000 agricultural holdings above one acre in area, and of these 143,000 were above fifty acres and 292,000 were above one and not above fifty acres in extent. Besides these there were a large number of allotments of one acre or less, the holders of which had in many cases some other occupation besides agriculture. Practically all the occupiers of land of above fifty acres, and a considerable proportion of the occupiers of smaller holdings, are financed by the joint-stock and private banks, which among them had in 1910 6,208 offices open for banking business; that is, one office to every 5,800 of population. These banks have branches in all the market-towns, and in many of the larger villages, and thus afford great facilities to the farmers, both large and small, as regards credit operations. The customary rate of interest which they charge on loans to agriculturists on satisfactory personal security is 5 per cent. per annum.

While these joint-stock banks are showing an increasing readiness to deal with agricultural loans of small amount, there is a large number of occupiers whose holdings are so small, and whose needs in the matter of credit are individually so petty, that it is difficult for them to open an account with a joint-stock bank; nor do they find it easy to obtain elsewhere the small loans they require. To meet such cases, an endeavour has been made to encourage them to form agricultural co-operative credit societies on the Raiffeisen model, but the attempt has hitherto met with but little success. At the end of 1910 there were in England and Wales forty such societies scattered over twenty counties. Only thirty-one sent in returns, from which it appears that they had 663 members, and assets aggregating £1,924, of which £1,421 were outstanding in loans to members. During the year they had advanced 119 loans amounting in all to £1,390. They obtained funds mainly from depositors, to whom at the end of the year they owed £1,088, while they had borrowed £489 from joint-stock banks. They generally paid 3 or 4 per cent. on deposits, and charged 5 or 6 per cent. on loans. The administration of the societies was almost entirely carried on by the members themselves without salary, and their working expenses for the year averaged a little over £1 per society. They had built up reserve funds amounting to £270.

All these forty societies are registered under the Friendly Societies Act, 1896, and so far as is known, there are no unregistered credit societies at work. They are all formed on a basis of unlimited liability without shares, and lend only to their members and only for profitable purposes connected with agriculture or rural industries. No loan can exceed £50. The members must reside within a certain circumscribed area, so as to be known to each other, and must be approved for admission by the committee. All members have an equal vote, and are equally, jointly and severally liable for the debts incurred by the society. Profits cannot be divided among the members, but must be carried to a reserve fund, which can only be drawn upon to meet exceptional losses by resolution of the general meeting of members.

The Act provides that the rules of a registered society must be accepted by the Registrar as being in accordance with the law, that its accounts must be annually audited and published and reported to the Registrar, and that the transactions of the society shall be exempt from stamp duty. The society can sue or be sued through its trustees or nominated officers.

Until recently the State took no active steps to encourage the development of these societies beyond making it possible to form and register them under the Friendly Societies Act. The work of organisation was left to the Agricultural Organisation Society, a voluntary body which concerns itself with the encouragement of all kinds of agricultural co-operation, including co-operative credit, and which is composed partly of private subscribers and partly of representatives of affiliated societies. Under the auspices of that society a Central Co-operative Agricultural Bank was formed with share capital and limited liability, and registered under the Industrial and Provident Societies Act, with the object of financing agricultural co-operative societies, but so far its operations have been insignificant.

Under Section 49 of the Small Holdings and Allotments Act, 1908, a county council may assist societies on a co-operative basis having as an object the provision or the profitable working of small holdings or allotments, whether in relation to the purchase of requisites, the sale of produce, credit banking, or insurance, and may make grants or advances, or guarantee advances made to such a society; but no grants or advances have yet been made by any County Council, in the exercise of this power, to any credit society.

Under the same section the Board of Agriculture and Fisheries were authorised to make grants to any society having as an object the promotion of co-operation in connection with the cultivation of small holdings or allotments; and in the two following years grants of State funds aggregating about £3,000 were accordingly made to the Agricultural Organisation Society. More recently, under the Development Fund Acts, 1909 and 1910, the Treasury is authorised, on the recommendation of the Development Commissioners, to make advances to a Government department, or through a Government department, to an association of persons or company not trading for profit, for the purpose, among others, of aiding and developing agriculture and rural industries by the organisation of co-operation. Advantage has been taken of this power to sanction a grant of £3,000, through the Board of Agriculture and Fisheries, to the Agricultural Organisation Society, to enable it to increase its staff and train organisers of co-operation. A scheme for the reconstitution of that society on a broader basis and for the provision of a larger amount of State funds to assist in its working is now under consideration. The Board are also endeavouring to arrange with the large joint-stock banks a system under which the managers of branches of these banks throughout the country will audit the accounts of credit societies free of charge, and will, when satisfied regarding the security offered, make advances to them at a moderate rate of interest, and subject in ordinary cases to a year's notice of recall.

II.—*Insurance.*—For nearly a century there have existed in this country small village societies formed on a co-operative basis for the insurance of the members' cattle against death from accident or disease. At first these were voluntary associations of individuals, unrecognised by the law in their corporate capacity, and the great majority of them have still no legal status as societies. The Friendly Societies Act contains provisions under which these live stock insurance societies can be registered free of charge, under similar provisions to those which have been described as regards credit societies, but comparatively few insurance societies have taken advantage of these provisions. At the end of 1910 the number of registered live stock insurance societies in England and Wales was only sixty, of which twenty-two were for the insurance of cows and calves, two for horses, three for horses and cattle, thirty-two for pigs, and one for the insurance of cattle held by butchers.

Besides these, there are a considerable number of unregistered cow insurance societies, and over a thousand unregistered pig insurance societies, for which statistics are not available. An endeavour is now being made by the Board of Agriculture and Fisheries to call the attention of these societies to the advantages of registration and to provide them with sets of model rules.

At the end of 1910 the twenty-two registered cow insurance societies contained 1,631 members, and insured 4,588 cows and calves, the smallest insuring fourteen animals, and the largest 1,329. During the year the contribution of the members to the insurance fund amounted to £929, and the income from other sources brought the total receipts up to £1,132. The amount of insurance paid on claims was £983, and the net result of the year's working was that the balance at credit of the insurance funds of the various societies rose during the year from £4,678 to £4,795. All the twenty-two societies had some balance to their credit.

The costs of management are met by a separate contribution from the members, and as the administration is generally carried on by the members themselves the total expenditure under this head was only £95, or less than 6*d.* per animal insured. Members usually pay an entrance fee on each cow, varying from 6*d.* up to 7*s.* 6*d.*, and a contribution varying from 4*s.* to 6*s.* per annum paid quarterly. They are also liable to a special levy should the funds fall short of the amount required to pay insurance, but only two societies had to make a levy in 1910. One of the most successful of the societies, that at Whixall, in Shropshire, which has been in existence for seventy years, had 307 members and insured 1,329 cows and calves; its entrance fee is 2*s.*, and the annual contribution 4*s.* per cow, and the society has been able to go on paying, on each cow that died, its value not exceeding £10, and to build up a reserve fund of £1,176—a very satisfactory result when it is considered that the lowest rate charged by ordinary insurance companies is 7½ per cent. on the value insured, which means a yearly premium of 15*s.* per cow for a payment on death of £10.

The pig insurance societies are managed on much the same lines, but statistics regarding them are not yet available.

So far as is known there are no co-operative societies for insurance against damage by hail, which is comparatively unimportant in this country.

In 1908, under the auspices of the Agricultural Organisation Society, there was formed an Agricultural and General Co-operative Insurance Society with limited liability, registered under the Industrial and Provident Societies Act, for the purpose of insuring on a mutual basis the agricultural and other risks of its members, who consist of persons holding not less than one £1 share and a policy of insurance from the society. Shares are issued to policy-holders only, and the interest on the shares is limited to 5 per cent. per annum, any surplus of profit being utilised to build up a reserve fund, with an arrangement which ensures that the portion of it due to the contributions of each member shall be paid to his heirs on his death. At the end of 1910 the number of members was 757, the subscribed share and loan capital being £26,140, of which £5,781 was paid up. The total income during the year was £2,481, the total expenditure £1,723, and the available profit, after paying interest on loans and allowing for depreciation, was £351.

III.—*Co-operative Purchase, Production, and Sale.*—The main object of agricultural co-operation in this country is to enable the members to carry on their daily occupation as individual farmers more efficiently and profitably by such means as the collective purchase of the manures, seeds, or implements required by the members, the collective sale in the open market of the products of the industry of the members in their individual capacity, or the collective preparation for the market of agricultural produce, so that each member may obtain a larger amount of individual profit than if he bought or sold, or marketed his produce by himself alone. Co-operation among agriculturists of this character has shown a marked advance during the last few years, the increases between the years 1899 and 1909 in England and Wales of societies registered under the Industrial and Provident Societies Acts or the Friendly Societies Acts having been as follows:—

Year.	Societies for Production.		Societies for Distribution.		
	No. of Societies.	Sales.	No. of Societies.	No. of Members.	Sales.
		£			£
1899 ...	10	30,132	8	1,019	33,637
1909 ...	18	66,506	145	13,589	885,683
Increase	8	36,374	137	12,570	852,046

Many of these societies have taken power in their rules to carry on both production and distribution, and many dairy societies also supply the agricultural requirements of their members, so that the classification given above is only approximate. At present the development has been mainly in the direction of societies for the joint purchase of the requirements of the members and the marketing of their individual productions. These societies are registered under the Industrial and Provident Societies Acts, usually with model rules prepared by the Agricultural Organisation Society. They have limited liability and share capital, the dividend on the shares being usually restricted to 5 per cent., and any surplus profit being carried to a reserve fund or distributed to the members in proportion to their sales through or purchases from the society. The rules generally provide that the shares shall be of the nominal value of from 5*s*. to £1, frequently payable by instalments. The principle of one vote per member, irrespective of the number of shares held, is usually adopted. The management is exercised by a committee elected by the members in general meeting. By joining such a society members obtain such advantages as buying small quantities of their requirements at wholesale prices, having fertilisers and feeding stuffs analysed, and getting a better price for their produce when sold in bulk than they could if they sold it in small quantities. There is also a considerable saving in freight, and in agency and commission charges. The most successful of the agricultural trading societies is the Eastern Counties Farmers' Co-operative Association, which in 1910 had a membership of 943, representing the holders of 269,000 acres, with a nominal capital of £6,722, a paid-up capital of £2,186, and annual sales amounting in that year to £277,000.

Most of these societies have become affiliated to the Agricultural Organisation Society, which at the end of 1910 had the following societies as members:—

	Number.
Societies for the supply of requirements and sale of produce	145
Dairy Societies	19
Egg and Poultry Societies	20
Auction Markets	3
Agricultural Credit Societies	39
Miscellaneous Societies...	9
Small Holdings and Allotments Societies	161
Total ...	396

IV.—*Small Holdings and Allotments Societies*.—In consequence of the passing of the Small Holdings and Allotments Acts of 1907 and 1908, and of arrangements made between the Board of Agriculture and Fisheries and the Agricultural Organisation Society, a considerable number of societies have been registered under the Industrial and Provident Societies Acts with the object of providing land for their members.

The most common form of these societies is that in which a number of intending small holders form themselves into a society, which in its corporate capacity negotiates for the hire or purchase of land either from the local authority or direct from the landowner, the society making itself the responsible hirer or purchaser of sufficient land to meet the needs of the whole of its members. The society divides the land into plots of different sizes to suit their varied requirements, and fixes a rent for the plots sufficient to meet in the aggregate not only the total rent to be paid to the owner (or the interest on the capital value if the land has been purchased), but also the expenses incurred by the society for the common benefit of the whole of the tenants. The society also performs functions which can be carried out more profitably in common than by each member individually, such as the ploughing of the whole area, the provision of water supply, &c. It purchases in bulk the seeds, manures, implements, and other requirements of the members, and collects, prepares, and markets their surplus produce. As every tenant is a member of the society with a direct responsibility for its good government, and a control over the division of any profit it may make, it is to the interest of each to see that the society's affairs are managed economically and well, and that his fellow-members are also doing their duty as tenants of the society. In 1909 there were 146 such societies on the register, with a membership of 7,925. They held 4,761 acres in small holdings, 917 acres in allotments, and 151 acres in grazing, and had provided for 4,337 tenants.

Summary.—Thus, although agricultural co-operation has not as yet been established to any large extent in England and Wales, it has in recent years shown marked development in various directions. The part played by the State in this development has been the passing of legislation which makes it possible for co-operative societies to be established and registered at small cost, and empowers County Councils to aid such societies by money grants or guarantees, and the provision of funds, through the Agricultural Organisation Society, for the propagation of co-operative ideas, the encouragement of new societies, and the combination of individual societies into larger co-operative unions.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

FIELD CROPS.

Varieties of Oats and Barley (*N. of Scotland Agric. Coll., Rept. on Field Trials in Morayshire and Nairnshire,* 1910).—In these trials, carried out at several centres in the two counties, seed was sown at rates depending on the number of seeds per acre, irrespective of the weight. As regard oats the rate was 3½ million seeds per acre, except in the case of Potato, and the similar variety, Pay Rent, for which the rate was 3 million seeds. This represented a seeding of 5½ bush. for Potato, 6½ bush. for Banner, and 9¾ bush. for Yielder. The barleys were sown at the rate of 2½ million seeds per acre, this representing from 3½ to 4½ bush. The oats varied a good deal at the different centres, owing largely to heavy rains causing the crops to lodge. At all the centres Yielder was the first to ripen, and in each case gave satisfactory crops of grain and straw. Of the barleys, Archer and St. Madoes, a variety raised in Perthshire, gave the heaviest yield of dressed grain, followed closely by Common and Chevalier. Invincible, Goldthorpe, and Maltster produced very similar results, and were but little inferior to those of the first four. Archer gave the heaviest weight of straw.

Varieties of Oats and Potatoes (*Univ. Coll. of N. Wales, Bangor, Bull. iii.,* 1911).—Several different varieties of oats and potatoes were tried at the College Farm in 1911. Bountiful, Waverley, Record, and Abundance gave the best yields of grain. Goldfinder gave a heavy total yield, but a large proportion of this was small corn. Potato gave the heaviest crop of straw and a fair yield of somewhat small grain of fine quality. Of the varieties of potatoes, Up-to-Date produced the heaviest total crop, and also gave the largest yield of marketable potatoes, though, like all the varieties with the exception of Langworthy, it was badly affected by disease.

Growth of Lucerne (*Univ. Coll. of N. Wales, Bangor, Bull. iv.,* 1911).—In 1910 and 1911 attempts were made to grow lucerne as a field crop at several centres in North Wales. In 1910 seed was sown at the rate of 24 lb. an acre along with a thin seeding of corn. In 1911 it was sown alone at the rate of 36 lb. an acre. The results were very irregular; at some centres the plant appeared to establish itself well, and at others it quite failed.

Mixtures of Grass and Clover Seeds (*Univ. Coll. of N. Wales, Bangor, Bull. ii.,* 1911).—Four different mixtures of grass and clover seeds are being tested in North Wales on plots laid down at five centres in 1909 and at four centres in 1910. Mixture A contains a considerable amount of both Italian and perennial ryegrass, with smaller quantities of permanent grasses. Mixture C contains no Italian ryegrass, but perennial ryegrass is included, along with fairly large quantities of permanent grasses. Mixture D is one of those used at Clifton Park, Kelso, by Mr. R. H. Elliot, and contains no perennial ryegrass, but has fair proportions of a large number of permanent grasses, and also some deep-rooted plants, such as chicory, burnet, kidney vetch, and yarrow. Mixture B is a modification of "Elliot's" mixture, costing about 40 per cent. less, and containing perennial ryegrass.

---

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

The crops were mown the first year., and the weights of hay are given. On an average plot D gave the heaviest crop, followed by plot B. It is observed that though the cost of Elliot's mixture is high, "the extra cost is almost invariably realised in the first hay crop." An examination of the notes made on the appearance of the plots at various times shows that the herbage produced by the same mixture at different centres varies to a considerable extent.

SOILS AND MANURES.

Residuary Effects of Manures Employed in the Experiments on Grass Land at Sevington (*Jour. Bath and West and Southern Counties Soc.*, 1911–12).—In the concluding report on these experiments it was stated that the manures were by no means exhausted, even though it was nine years since they were applied, and it was decided to continue to keep a record of the produce of the different plots at Sevington for the seasons 1910 and 1911. In the former season the grass was mown for hay, in the latter it was grazed with sheep for two months, the manured plots—each three acres—receiving ten sheep, the unmanured plot seven, that being quite as many as the plot could carry. The following table gives the manurial treatment of the plots, the approximate weight of hay obtained in 1910, and the total increase in the live weight of sheep fed in 1911 on the different plots:—

Plot.	Treatment per cwt.	Approximate weight of Hay per acre, 1910.	Increase in Live-weight per acre in Two Months, 1911.
		cwt.	lb.
I.	Cotton Cake fed in 1901, 1902, 19 7, and 1908	16	60·0
II.	4 tons Lime in 1901; 5 cwt. Basic Slag in June, 1907	23	80·6
III.	10 cwt. Basic Slag for 1901...	30	80·6
IV.	5 cwt. Basic Slag for 1901; the same for 1904	26	87·0
V.	7 cwt. Superphosphate for 1901; the same for 1904	21	76·0
VI.	Untreated throughout	14	56·0
VII.	Superphosphate as on Plot V. with 1½ cwt. Sulphate of Potash for 1901, 1903, and 1907	21	91·0
VIII.	Superphosphate as on Plot V. with ½ ton Ground Lime for 1901, 1903 and 1907..	26	77·0
IX.	Superphosphate as on Plot V. with 97 lb. Sulphate of Ammonia for 1901, 1903, 1904, and 1907	26	82 3
X.	6 cwt. Dissolved Bones for 1901 and 1904	26	78·0
XI.	Untreated in 1900, 1901, 1902; 5 cwt. Basic Slag in 1903; Cotton Cake fed each year subsequently	26	79·3

It is not intended to draw comparisons between the results from the various manurings—the grazing period in 1911 was too short to allow of that being done satisfactorily—but the figures quoted show that the effects of the manures applied to the plots were by no means exhausted when the experiment closed.

(A full account of the Sevington and other experiments on the manuring of grass land is given in a supplement to the *Journal* of the Board issued in January, 1911.)

Manuring of Turnips (*N. of Scotland Agric. Coll., Rept. on Field Trials in Morayshire and Nairnshire,* 1910).—A complete manurial experiment, comprising twelve plots, was carried out at each of three centres. It was demonstrated that the three manurial ingredients—phosphates, potash, and nitrogen—were relatively important in the order named. There appeared to be little difference in value between the different forms of nitrogenous manure tested. Superphosphate exerted a greater influence on the crop than ground rock phosphate.

Manurial Requirements of Willows (*Bull. de la Société centrale forestière de Belgique,* November-December, 1911).—Experiments in Belgium have shown that the willow contains from 3·7 to 6 per cent. of ash, showing that although it can be grown on a variety of soils, good soils are necessary if remunerative crops are to be obtained. Reckoning the production of dried rods per acre at from 2,700 lb. to 3,600 lb., the following quantities of manurial substances will be taken from the soil:—Phosphoric acid, 13 lb.; potassium, 17 lb.; lime, 18 lb.; sodium, 9–10 lb.; and nitrogen, 35–40 lb. per acre. Although these amounts are less than in the case of most other crops, they show the need of a manure for willows, above all, potassic or nitrogenous.

Experiments to test the point, confirmed the importance of a nitrogenous manure for willows, although, if given in excessive quantities (above about 140 lb. per acre in the case of nitrate of soda) there is a risk of the willows being feeble and containing an excessive amount of pith. The manuring to be given per acre would be about 89lb. nitrate of soda, 178 lb. kainit, and 356 lb. basic slag. In all cases, however, analyses of the soil should be made and individual experiments carried out on some such plan as the following:—Nine plots each of about 120 sq. yds. should be taken; to these should be given (1) 18 lb. basic slag; (2) 4½ lb. nitrate of soda; (3) 66 lb. lime; (4) 18 lb. basic slag, 4½ lb. nitrate of soda, and 66 lb. lime; (5) 66 lb. lime, 9 lb. kainit, and 4½ lb. nitrate of soda; (6) 18 lb. basic slag, 4½ lb. nitrate of soda, and 9 lb. kainit; (7) 9 lb. kainit; (8) 18 lb. basic slag and 9 lb. kainit; (9) no manure. The manures should be applied in February and ploughed in.

HORTICULTURE.

Self-sterility and Self-fertility in Plums (*Abs. of Papers read at Meeting of Brit. Assoc.,* 1911; *Mr. W. O. Backhouse—John Innes Hortic. Inst.*).—In 1910 three varieties of plums were experimented with, the method adopted being to exclude insects and wind-blown pollen by enclosing suitable branches in paper bags before the flowers had opened. At the height of the flowering period, the bags were taken off and the flowers carefully hand-pollinated with their own pollen, being then covered up again immediately. Of the three varieties, Victoria set fruit on nearly every flower, but River's Early Prolific and Greengage set practically no fruit. Nine flowers of Greengages pollinated from River's Early Prolific set nine fruits. In 1911 the trials were extended; some varieties were tested in the open as before, but others were in pots in a fruithouse, from which insects were almost entirely excluded. Of those in the open, which were treated by the same method as that adopted in the previous year, Victoria, Prince Engelbert, Czar, Pershore, Yellow Magnum Bonum, and a variety of Damson, when fertilised with their own pollen, all set fruit to such an extent that it had to be heavily thinned. Histon Gage, Early Orleans, Late Orleans, Late Orange, Sultan, Korke's Blue, and a variety of sloe set absolutely no fruit when self-pollinated, and River's Early Prolific only set two fruits on the twenty-eight branches enclosed in bags.

Of those in the house which were carefully hand-pollinated with their own pollen, flower by flower, Denniston's Superb, Early Transparent, and Reine Claude Violette set nearly every flower. Coe's Golden Drop, Washington, Late Transparent, Blue Imperatrice, Early Greengage, Old Greengage, and Reine Claude d'Althan set no fruit except on one or two flowers, which were in such positions as to make an accidental cross very probable. River's Early Prolific set ten fruits out of about one hundred and ten flowers.

It was noted that in cases where the flower of a self-sterile plum is not pollinated at all it falls within three or four days. If self-pollinated, the carpel may swell to the size of a culinary pea before dropping.

Cider Sickness (*Jour. Bath and West and Southern Counties Soc.,* 1911–12; *Investigations at the National Fruit and Cider Institute*).— Cider sickness is a common disorder, sometimes spoken of as second fermentation, affecting sweet ciders, usually in hot weather. In different cases the symptoms are slightly different, but, generally speaking, there is a violent fermentation accompanied by the development of an unpleasant aroma and flavour, and generally also of a dense turbidity of the liquor. It is found in all the important cider-making districts, not only in this country, but also in France, but some localities are much more prone to it than others, while in some seasons it is much worse than in others. The disorder is due to the action of a special bacterium, which has been isolated and studied by Messrs. Barker and Hillier. The organism is so widely distributed that it was found that the variation in occurrence of the sickness depends not so much on the greater or less prevalence of the bacteria as on variation in the factors influencing its growth and development. The most important of these are the rate of fermentation, the proportion of acid present, and the temperature to which the cider is exposed. Juices which ferment rapidly yield ciders which are not so liable to sickness as those which ferment slowly. This appears to be partly due to the fact that a vigorous alcoholic yeast fermentation prevents the development of the sickness bacteria in the period of active primary fermentation, and partly to the fact that a rapid rate of fermentation of the juice means that very little sugar remains in the mature cider. As sugar is essential for the multiplication of the bacteria, sickness, if occurring at all, can only be slight in a cider containing little sugar.

The effect of acidity in preventing development of the bacteria is considerable. The more malic acid present, the less is the liability to sickness. About 0·5 per cent. of acid in ordinary cases is sufficient to prevent the disorder, but where other conditions are very favourable to it at least 1 per cent. is necessary if certain immunity is required.

This effect of acidity explains many well-known facts as to the occurrence of the trouble. For instance, in districts or in seasons in which "sharp" apples predominate, there will be less sickness than when "bitter-sweet" and "sweet" varieties are more abundant. Season, however, is effective in other ways. Even in the same variety of apple acidity is generally considerably higher after cold sunless summers than after warm sunny ones. Furthermore, the rate of fermentation of the juice is directly affected for the same reason, while the temperature to which the cider is exposed after the primary fermentation has ceased is of considerable importance. High temperatures favour sickness, and if cider is stored in a temperature below 50° F. the risk is inconsiderable.

Tannin was not found to exercise any check on the growth and development of the injurious bacteria.

The following measures are recommended as likely to prevent sickness:—(1) Suitable blending to raise the amount of acidity and to give a moderately rapid rate of fermentation; (2) storage at as low a temperature as possible; (3) bottling of ciders liable to the disorder early in the season instead of at the usual period; (4) sterilisation of all vessels and appliances with which the juice or cider comes into contact.

Pollination of Hardy Fruits (*Jour. Roy. Hort. Soc., March,* 1912; *Mr. C. H. Hooper*).—These investigations were carried out in order to see (1) how far ordinary fruit flowers will set fruit without visits of insects to the blossoms; (2) to what extent fruit will be set by flowers pollinated with their own pollen; and (3) whether fruit blossoms when pollinated with pollen from another variety will set fruit more plentifully or of higher quality than when fertilised with their own pollen.

In order to prevent entrance of insects or of pollen blown by wind muslin or paper bags were used to enclose the flowers. The results obtained may be summarised as follows.

Gooseberries, Red and White Currants.—When insects were excluded, practically no fruit was formed. They proved, however, all self-fertile, *i.e.*, they set fruit perfectly when pollinated with pollen of the same flower or variety, but the pollen is sticky and cannot be transferred from the anthers to the stigma without mechanical means, such as is provided by visits of insects.

Cherries.—Not a single fruit set when insects were excluded. Attempts to fertilise flowers with their own pollen resulted in the formation of fruit in many cases, but except in the Morello, none of the fruit matured. All the flowers pollinated from another variety set fruit.

Plums.—A certain number of the blossoms enclosed in bags and left untouched set fruit, and still more set fruit when artificially pollinated with their own pollen. All the varieties, except perhaps "Victoria," seemed to set finer fruit more plentifully when pollinated from another variety.

Pears.—The tests with these were not carried as far as in the case of the other fruit, but two varieties, Duchess d'Angoulême and Colmar d'Eté, pollinated from the same variety, set and matured fruits. A few others set fruit but it did not mature.

Apples.—Out of sixty-three varieties of apples on which unopened blossoms were enclosed and left untouched the only one on which fruit set and matured was Irish Peach. Of those enclosed and pollinated with their own pollen by brush, only the following set and matured fruit—Irish Peach, White Transparent, Newton Wonder, Ecklinville, Summer Golden Pippin, Baumann's Red Winter Reinette, Peasgood's Nonesuch, Christmas Pearmain, King of the Pippins, Washington, and Adam's Pearmain. James Grieve and American Mother were doubtful. Others failed to set or mature fruit when pollinated with pollen of the same variety. In nearly all the crosses good fruits resulted. Of the 64 crosses made, 48 were successful.

Strawberries seem to be less dependent on insect agency than any other of our hardy fruits. Enclosed blossoms set fruit as well, or nearly as well, as those not enclosed.

Raspberries and Loganberries set fruit when flowers were enclosed in muslin bags, but the results were not so good as with flowers unenclosed.

It is concluded that fruit blossoms generally are dependent on the visits of insects, and for want of these many fruit plantations do not yield their best. Where there are few hives near, and where wild bees are not plentiful, one or more hives should be placed in fruit plantations. In the case of most varieties of apples, pears, plums, and cherries it is advantageous to have in close proximity a different variety flowering at about the same time.

INSECT AND FUNGUS PESTS.

"Wart Disease" or "Black Scab" of Potatoes.—In continuation of the experiments carried out in previous years, and noted in the *Journal* for April, 1911, and December, 1909, investigations were conducted on behalf of the Board in 1911 at the Harper-Adams Agricultural College. In the previous trials no satisfactory results had been obtained with the different fungicides tried, and only a few, including two proprietary "remedies," were tested in 1911. Most attention was paid to tests with varieties, and, in addition to a great many new kinds tried, varieties which had previously only been tested one year were again grown. The effects of various methods of cultivation, and of injecting solutions of copper sulphate into seed tubers were also tested, and a plot was laid down to discover how many years are required to starve out the disease.

Resistant Varieties.—Of the 108 species and varieties under test for the first time, 39 were found to be immune, but of these only about six have any value for garden cultivation, and only two are suitable for growing in the field. All varieties found to be immune in 1910 were again resistant to the disease in 1911, though many of them failed to produce even a moderate crop. Of the late varieties, Crofter gave the best crop, while White City and Chiswick Favourite were also very good. Of the second early varieties, Abundance and the closely related Aberlady Early, along with Conquest, were the best. Snowdrop, Southern Star, and Southern Queen were the most satisfactory of the earlies.

Fungicides.—Application of calcium hypochlorite, copper nitrate, potassium ferrocyanide, and potassium permanganate diminished the disease without affecting the crop. Ammonium sulphocyanide reduced the amount of disease but also affected the total crop. Both of the proprietary materials tried proved failures.

Vitality of the Spores of Wart Disease.—In order to determine how many years are required to starve out the disease, a plot of well-infected ground was sown down with lucerne and grass, and carefully fenced in so as to prevent rabbits reinfecting it. A portion of this plot will be dug up each year and planted with potatoes.

Methods of Cultivation.—Deep cultivation by bastard trenching gave a greater crop and a smaller proportion of diseased tubers. Late planting gave no results as far as disease was concerned, but deep planting (one foot as against four or six inches) appeared to give a sounder crop when the soil was only loosely filled into the trenches after planting and not trodden down.

Injecting the seed tubers with weak solutions of copper sulphate stimulated the haulm, but did not diminish the amount of disease.

A piece of ground was purposedly infected by removing at one place a cubic foot of soil and filling the hole then made with soil from an infected area. The whole piece was afterwards dug over, and potatoes planted to see how rapidly disease would spread from the centre of infection. It was found that it had only extended eighteen inches in the direction in which the soil was dug, while on the opposite side there was only a trace of disease on a plant nine inches from the infected soil. It is concluded that the disease does not itself spread rapidly in the soil, but is soon spread over great areas by careless methods of dealing with affected plants, particularly the picking off of warty growths from tubers and throwing or leaving them about instead of destroying them, and the careless disposal of haulms from affected crops.

Up to the present the most promising method of dealing with the disease has appeared to be that of selecting varieties immune to it, and in order to try to increase the number available a number of seedlings have been raised, some of which appear promising.

It is interesting to note that both *Solanum etuberosum* and *Solanum commersoni* proved immune, and the question arises as to which of the ancestors of varieties such as Up-to-Date, British Queen, &c., introduced susceptibility to the disease.

Streak Disease of Sweet Peas (*Jour. Roy. Hortic. Soc., March,* 1912).—In the Board's *Journal* for March a note was given on investigations carried out at Kew by Mr. G. Massee. In the article now under consideration, Mr. F. J. Chittenden describes independent investigations carried out at the Wisley Laboratory on the same fungus, *Thielavia basicola,* Zopf, with particular reference to it as a cause of streak disease of sweet peas. An account of the structure and life-history of the fungus is given, and it is suggested that it is not a true parasite, but only attacks plants weakened by unhealthy conditions. Attempts to transmit the disease to healthy plants failed, but plants of which the roots had been weakened by over-watering were readily attacked. It is concluded that any cause tending to the weakening of the root of the sweet pea will lay it open to the attack of the fungus. A common cause is the presence of too much water in the soil, even if only for a short time. Excessive watering should be avoided, drainage must be thoroughly efficient, and every care should be taken to incorporate manure used thoroughly with the soil. It is concluded that if care be taken to avoid check to root development and activity the streak disease will cease to be so troublesome.

Spraying of Potatoes (*Univ. Coll. of N. Wales, Bangor, Bull. v.*, 1911).—Spraying experiments were continued, as in previous years, at several places in the four counties of North Wales, to test the effect of spraying early, spraying late, and spraying twice. Owing doubtless to the dry season, the results attending the operation were not so pronounced as in previous years; but still, on an average, there was an increase of over a ton per acre in the weight of marketable potatoes as a result of the late spraying. At some centres the spraying, particularly on the plot treated early, appears to have done harm.

The following table gives the average results for the past four years:—

Year.	Average Weight of Marketable Potatoes per Acre.							
	Unsprayed.		Sprayed once (early).		Sprayed twice.		Sprayed once (late).	
	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.
1908	8	0	9	9	10	1	8	19
1909	10	4	10	19	12	17	12	11
1910	7	18	9	9	10	5	9	5
1911	12	3	12	15	13	7	13	8

Instructions for preparing the mixture and spraying are given. Washing soda is recommended in preference to lime.

Cabbage-top in Swedes and the Swede Midge (*Univ. of Leeds and Yorks Council for Agric. Educ., Rept. No.* 82).—The condition in swedes known in Yorkshire as cabbage-top appears to be of very common occurrence, *e.g.*, of 155 fields examined in July and August in 1911 in the East and West Ridings only one appeared to be free from it. Examination shows that the name is given to two distinct conditions. In one form, instead of the usual large crown of foliage supported on a single neck, the plant shows an irregular mass of leaves borne on a number of short stems or necks. In the second form, the single neck persists, and there is no development of secondary shoots, but the young leaves are attacked and show a characteristic distortion, the chief feature of which is the crumpling or puckering of the leaf.

The first condition is caused by the destruction of the leading or terminal bud in the heart of the young crown, which may be brought about in various ways. The second condition, or crumpled leaf, is, however, always caused by the attack of an insect, *Contarinia nasturtii*, Kieff. This is a small midge, light yellowish-brown in colour and about one-sixteenth of an inch in length. The fully developed midges themselves do no harm, but they lay eggs on the upper surface of the stalks of young leaves in the heart of the crown. From these eggs larvæ hatch out in a few days and feed on the young leaves. They do not burrow into the leaves, and the amount of material consumed is so small as to be negligible were it not for the fact that in response to the irritation the growth of the plant becomes quite altered. The affected leaf-stalks become swollen, and, bending inwards, press upon the leading bud in the crown. Moreover, the leaves become delicately crumpled like those of a savoy cabbage. This appearance persists even after the insects have disappeared, and after the plants have to a certain extent recovered from the attack. The maggots feed on the swedes for about three weeks; when full grown they drop off the plants, bury themselves in the ground, enclose themselves in silken cocoons, and turn into pupæ. In summer they remain in this stage for two or three weeks, but the last autumn brood of midges spends the whole winter in the soil. At Garforth the first brood appears on an average during the first fortnight in June, and the last of the season about September, the total number of broods in the summer being apparently three in an ordinary season, though in the hot summer of 1911 four broods were observed, each occupying rather less than six weeks.

It was found that in addition to causing the crumpled leaf appearance, the midge is commonly the cause of the "many-necked" condition. If a sufficiently large number of eggs are deposited near the leading bud, the larvæ which hatch out will destroy the growing point, and thereby induce the many-necked condition. While, however, crumpled leaf is always the result of attack by the midge, the many-necked condition may be caused by other insects, and also by crown rot, a bacterial disease which sometimes injures swedes in autumn by destroying the central shoot.

It is considered to be unlikely that any of the young swedes are killed outright by the midge, as the attack does not take place until the plants have got well into the rough leaf. On the other hand, it seems certain that a considerable reduction in weight of crop takes place, though so far the amount has not been accurately determined. It is also certain that the damage is done chiefly by the first brood early in June. So far the only method of prevention attended with any success has been that of trapping. Owing to the rotation of crops, the midges coming out of the old swede field in June are compelled to migrate to some other field if eggs are to be laid on swede plants. It seems probable that the migrating midges will deposit their eggs on the first plants they come to—it has been observed that plants at the edge of the field are always attacked first—and it is suggested that a row or two of swedes might be sown on the headlands of the old field and destroyed as soon as eggs have been laid. This plan involves the sacrifice of the barley on the headlands, but as the swedes should usually be removed and destroyed about the end of June, grass and clover seeds could be sown, as on the rest of the field. It is pointed out that such a plan, to be really effective, would have to be adopted generally as a regular practice.

The midges, or closely related species, attack cabbages—causing one form of "blindness"—savoy, rape, and wild radish, and occasionally white turnips, though owing probably to the lateness of sowing the latter are comparatively little affected. Further research is needed to ascertain how far Cruciferous weeds may harbour the midge.

LIVE STOCK AND FEEDING STUFFS.

Cattle Feeding Experiments and Manurial Value of Cake (*Norfolk Agric. Sta., Ann. Repts.*, 1908–9, 1909–10).—In a cattle-feeding experiment conducted in 1908–9 two lots were fed under very different conditions. One lot of ten bullocks was fed in an open yard on a diet of roots and oat straw chaff *ad lib.*, with only about 1 lb. of common cotton cake per head daily. The other lot of twelve (these were really fed in two different pens, but for the sake of clearness they may be considered together) were fed in boxes, completely under cover, and received a ration containing up to 10 lb. per head of concentrated food a day, in addition to as many roots as they cared to eat, and about 8 lb. a head of straw and hay chaff. The concentrated food supplied consisted of cotton cake, linseed cake, soy bean cake, and bean meal. It is unnecessary to go into the quantities of each, but it may be said that the proportions were such as would be used by an average cattle feeder.

The foods and litter supplied were weighed and sampled, and analysed throughout the fattening period, which was twenty weeks in each case, and the amounts of nitrogen supplied to the two lots are given in the following table:—

Foods.	LOT I. CAKE FED.		LOT II. PRACTICALLY NO CAKE.	
	Total Weight per head supplied in 20 weeks.	Weight of Nitrogen supplied per head in 20 weeks.	Total Weight supplied per head in 20 weeks.	Weight of Nitrogen supplied in 20 weeks.
	lb.	lb.	lb.	lb.
Cake	1,060	45·2	129	4·5
Hay Chaff	400	6·6	—	—
Oat Straw Chaff ...	801	3·9	945	4·6
	tons. cwt.		tons. cwt.	
Swedes and Mangolds ...	10 7	36·8	10 6	36·7
Litter	1 15	15·2	1 17	16·2
Total Nitrogen supplied per head	—	107·7	—	62·0

The yards and boxes were thoroughly cleaned out before the experiment began, and when the manure made by the different lots was carted out it was weighed, sampled and analysed separately.

It should be pointed out that under the amount described as loss is the quantity of nitrogen retained by the animal in its increase in weight. This is, however, very small (the increase in weight of a fattening animal consists mainly of fat and water) and does not appreciably affect the results.

	Total Weight of Manure produced per head.		Total per cent. Nitrogen in Manure.	Total Amount of Nitrogen in Manure per head.	Total Amount of Nitrogen supplied per head. Food and Litter.	Loss of Nitrogen, lb. per head.	Proportion of Nitrogen lost.
	tons.	cwt.		lb.	lb.	lb.	per cent.
Cake-fed, Boxes	6	19	0·496	77·6	107·7	30·1	28
No Cake, Open yards	7	16	0·245	42·9	62·0	19·1	31

It will be seen that cake-feeding produced dung considerably richer than that from the animals given little cake, the former containing 0·5 per cent. of nitrogen, or over 11 lb. per ton, as compared with just half the amount in that from animals fed practically without cake. Furthermore, in the "cake-fed" dung three-tenths of the total amount of nitrogen was in the form of ammonia, as compared with only one-tenth in the case of the other dung. In order to see how far the extra quality of the richer dung could be realised in the form of crops the manure from the two lots of animals was used for growing mangolds on poor, light land. Two plots of 1½ acres each were treated with 10 tons per acre respectively of each kind of manure, with the following results:—

	Weights of Mangolds per acre (Average of two plots).	
	tons.	cwt.
No Cake Manure	15	11
"Cake-Fed" "	17	15
Average Return per acre for Cake Feeding	2	4

The plots are to be kept distinct, and the produce weighed through a whole rotation, but the results up to date may be compared as follows:—

The total quantity of manure produced by the ten bullocks receiving no cake was 78 tons. The same quantity of "cake-fed" manure would have given 17 tons 1 cwt. more mangolds, but would have cost (after allowing for the gross profit made on the two lots of animals) £12 13*s*. more to produce.

Therefore if mangolds are valued at 7*s*. a ton, there is a loss so far against the cake feeding to the extent of £12 13*s*. less £6 2*s*. (the assumed value of 17 tons of mangolds), or £6 11s. per 78 tons of dung produced, or about 1*s*. 8*d*. per ton. It remains to be seen how much of this will be recovered in future crops.

OFFICIAL NOTICES AND CIRCULARS.

Show of Thoroughbred Stallions, 1912.

The second Show of Thoroughbred Stallions held under the auspices of the Board and the Hunters' Improvement Society took place at the Royal Agricultural Hall on March 12th, 13th, and 14th, and was attended on the second day by their Majesties the King and Queen.

Several alterations have been made in the conditions of award of King's Premiums which obtained last year, the most important being as follows:—

(1) The average value of a King's Premium has been increased from £150 to £176.

(2) Ten awards, termed Super-Premiums, of a value of £105, were offered by the Board for stallions of exceptional merit to which King's Premiums had been awarded.

(3) No stallion was accepted for entry unless it was on the Board's Stallion Register, *i.e.*, had been passed as sound and suitable for breeding purposes by a veterinary inspector appointed by the Board.

(4) Every stallion to which a Premium was awarded is required to *travel* a route prescribed by the Board.

These alterations in the conditions of entry have met with the general approval of those concerned, and the entries, which numbered 111, are larger than in any previous year, consideration being taken of the number of stallions (23) rejected on veterinary examination.

Fifty Premiums and ten Super-Premiums were awarded, and the judges, who were Sir Gilbert Greenall, Bart., C.V.O., Captain C. H. D. Fetherstonhaugh, and Mr. E. P. Rawnsley, M.F.H., reported that the winners taken as a whole were horses of a kind that cannot fail to do good in the country, and that the ten to which Super-Premiums were awarded were of exceptionally high standard; and further, that in their opinion there was a higher standard of excellence generally than has been seen at these shows in former years.

The Challenge Cup, which is offered by his Majesty the King, was won by Messrs. T. L. Wickham-Boynton and H. A. Cholmondeley with their stallion, King's Courtship, and it was presented to the winners, together with the Board's gold medal, by the King in person. The reserve stallion was "Wales," the property of Lord Middleton.

The routes for the King's Premium stallions and the appointment of stallion committees to supervise the service arrangements are being settled this year by the Board in consultation with the Horse-breeding County Committees concerned, and full particulars of them will be published by the Board in due course.

The Wart Disease of Potatoes Order of 1912.

The Board of Agriculture and Fisheries have made an Order, dated March 12th, 1912, entitled the Wart Disease of Potatoes Order of 1912, with a view to the prevention of the spread of Wart Disease in Great Britain. The following are the chief provisions of the Order:—

3. *Notification of Disease.*—The occupier of any premises on which

disease exists, or appears to exist, shall forthwith notify the fact by post or otherwise to the Board, or to an Inspector or other officer of the Board or of the Local Authority authorised to receive such notification, and where practicable a specimen showing the disease shall accompany the notice.

4. *Precaution to be Adopted in Case of an Outbreak or Supposed Outbreak of Disease.*—No tubers shall be removed from any premises on which disease exists or appears to exist until after the investigation required by the next Article.

5. *Investigation by Local Authority.*—(1) The Local Authority on receiving in any manner notice of the existence or apparent existence of disease shall forthwith take such steps as may be necessary to determine on what premises the disease exists, and shall cause notice of such determination to be served on the occupier of each of such premises, which, within the limits specified in the notice, shall thereupon become "infected premises" and continue to be infected premises until the notice is withdrawn, but the limits of the infected premises may be extended by a notice served by the Local Authority on the occupier of the infected premises.

(2) The notice shall as far as practicable include in the infected premises only those lands in which there are or recently have been diseased tubers.

6. *Action to be taken after Preliminary Investigation.*—(1) The Local Authority may at any time and from time to time by a notice served on an occupier of infected premises require him to adopt such measures for prevention of the spread of the disease as are authorised by this Article and specified in the notice.

(2) A notice under this Article may require the occupier of the premises to adopt any one or more of the following measures:—

(*a*) to destroy any part of the crop, except the tubers, by fire or such other suitable method as may be specified in the notice;

(*b*) to boil thoroughly all diseased tubers;

(*c*) to take such other steps as the Local Authority may consider necessary to prevent the disease being conveyed to other premises.

(3) Nothing in this Order shall prevent the destruction by the owner thereof, by fire or other effective method, of any diseased tubers.

(4) A notice under this Article may prescribe the time within which the adoption of any measure thereby prescribed shall be completed.

7. *Power to Prohibit the Planting of Potatoes on Infected Premises.*—The Local Authority may by a notice served on the occupier of any infected premises prohibit the planting of potatoes in the infected premises except under such conditions as may be prescribed in the notice.

8. *Prohibition of Use and Sale of Diseased Potatoes for Seed.*—It shall not be lawful to use any diseased tubers for planting, or to sell or offer for sale diseased tubers for that purpose, and an Inspector of the Local Authority acting under their directions may by a notice served on the occupier of any infected premises prohibit the removal of any tubers from the infected premises except under such conditions as the Inspector acting under such directions may consider necessary

to prevent any diseased tubers being so used or sold or otherwise disposed of for planting.

11. *Information to be given as to Diseased Potatoes.*—Every person who has or has had in his possession or under his charge any diseased tubers, and every person who as auctioneer, salesman or otherwise has sold or offered for sale any such tubers shall, if so required in writing by the Board, or the Local Authority, or an Inspector of the Board or of the Local Authority, give the Board, or the Local Authority, or the Inspector, as the case may be, all such information as he possesses as to the persons in whose possession or under whose charge they are or have been; Provided that any information given under this Article shall not be available as evidence against the person giving the same in any prosecution under this Order, except in respect of an alleged failure to comply with this Article.

The Destructive Insects and Pests Order of 1910 in so far as it applies to Wart Disease or Black Scab of Potatoes is revoked.

Colonial and Foreign Statistics for 1910.

The Board have recently published Part IV. of the Agricultural Statistics for 1910 [Cd. 6058] containing returns of the acreage and production of crops and the number of live stock in the British Empire and in foreign countries, together with certain tables relating to the prices of agricultural commodities in different countries. This report contains an Index to Parts I., II., III., and IV. of the Agricultural Statistics for 1910, and may be obtained from Messrs. Wyman and Sons, Fetter Lane, E.C., price 7*d*.

Removal of Restrictions on the Importation of Animals into the United States from Great Britain.

The Board of Agriculture and Fisheries have been officially informed that the prohibition against the importation into the United States of cattle, sheep, and other ruminants and swine from Great Britain, which was imposed in consequence of the outbreaks of Foot-and-Mouth Disease in this country last year, has now been removed, and that the United States Department of Agriculture are prepared to resume the issue of permits for the importation of such animals.

MISCELLANEOUS NOTES.

Agricultural Machinery Abroad.

Agricultural Machinery in Algeria.—The British Acting Consul-General at Algiers reports that certain trials of agricultural motor appliances have been arranged to take place in Algeria from May 26th to June 15th next, under the auspices of the Directorate of Agriculture. Foreign manufacturers will be allowed to participate in the trials. Applications for this purpose will be received by the "Directeur de l'Ecole d'Agriculture, Maison-Carrée," Algeria, up to April 30th.

A copy of the regulations (in French) may be seen, and a few copies of the form of application obtained, by British manufacturers on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. (*Board of Trade Journal,* March 14th, 1912.)

Agricultural Machinery in Uruguay.—H.M. Vice-Consul at Montevideo (Mr. T. D. Dunlop) reports that an international competition of agricultural motor machines has been organised by the "Asociación Rural del Uruguay," under the auspices of the Ministry of Industry, and the trials will take place during the period May 1st to October 1st. Competitions will be held for the following classes of agricultural motors, viz.:—Steam ploughs, motor dragging-ploughs, motor traction-ploughs, soil-cultivation machines, motor cultivators and spades, motor seed-planters, and motor mowing machines. (*Board of Trade Journal,* March 14th, 1912.)

Importation Regulations.

Prohibition of Importation of Cattle, &c., into German South-West Africa from Europe.—The "Deutsches Kolonialblatt" for March 1st contains an Ordinance of the Governor of German South-West Africa prohibiting, until further notice, the importation of cattle, sheep, goats, and pigs into the Colony from Europe.

The Governor is, however, empowered to permit exceptionally the importation of these animals from specified parts of Europe under special safeguards. (*Board of Trade Journal,* March 14th, 1912.)

Importation of Potatoes affected with Wart Disease into Algeria.—A decree of December 5th, 1911, prohibits the importation into Algeria of potatoes affected with Wart Disease (*Gale noire*). (*Journal Officiel,* December 5th, 1911.)

Notes on Agriculture Abroad.

Measures against Tuberculosis of Cattle in Germany.—The German Animal Diseases Law of June 26th, 1909, made compulsory the reporting of the existence of tuberculosis among cattle by the owners or attendants of such cattle, tuberculosis being defined for this purpose as "externally recognisable tuberculosis, if found in the lungs in an advanced state, or if it has attacked the udder, the uterus, or the intestines."

The treatment of affected cattle varies according to whether the animals are suspected of being diseased, whether disease is highly probable, or whether the disease is established, and as to the organs of the animal which are diseased.

The regulations contain detailed instructions to veterinary surgeons for carrying out the clinical and bacteriological tests on cattle.

Slaughter and Isolation of Animals.—The Act provides that the slaughter of animals proved to be, or in all probability, suffering from tuberculosis may be ordered by the police, and compensation is recoverable by the owner if the animal is slaughtered, or if, after the order for slaughter, the animal died of the disease. The regulations made under the Act provide that in exceptional circumstances slaughter may be delayed for not more than six weeks, but in this case, and also where slaughter is not ordered, preventive measures against the further spread of the disease must be taken, such as disinfection of cow byres, &c., marking infected animals (preferably by a metal mark in the left ear) for purposes of identification and isolation of such animals from the rest of the herd. Animals suspected of being diseased must be isolated until confirmation of the disease is obtained, when they are slaughtered, or until the suspicion is removed.

Disposal of Milk.—The milk of cows in which the existence of tuberculosis is established or regarded as highly probable must not be sold or used for human consumption until after it has been heated to a sufficiently high temperature. The milk from cows suffering from tuberculosis of the udder may not, even after heating, be used either as human food or for conversion into dairy produce, In all the preceding cases special vessels must be used for the milk from diseased or suspected cows. The milk from cows which are suspected of suffering from tuberculosis of the udder is subject to the same restriction, but there are no regulations with regard to the milk of cows suspected of suffering from other forms of tuberculosis.

Disposal of Suspected Animals.--In addition to the regulations as to isolation and disposal of milk already given, suspected animals are to be re-examined. If tubercle bacilli are not found in discharge from the lungs, udder, uterus, or intestines, the restrictions are removed. If the further veterinary examination does not include bacteriological tests, it must not be made until after three months from the first examination. If no decision can be arrived at from this examination a bacteriological test must be carried out.

Notes on the Weather in March.

The weather during the *first* week of March (March 3rd to March 9th) was unsettled, with occasional rain over Great Britain as a whole, and daily falls at many places in the west and south-west Warmth was "unusual" over the whole country, the excess above the average amounting to rather more than 4° in the east and south-east of England. Rainfall was less than the average in Scotland N. and E., but above it elsewhere, the excess being rather large in most districts. The amount of bright sunshine recorded was "moderate" in Scotland E., England N.E. and E., and the Midland Counties, and "abundant" in all other districts.

The weather continued unsettled in its general character throughout the *second* week. Temperature was again above average, the excess being 4° in England E., and more than 3° in nearly all parts of Great Britain. Rainfall varied in different districts, being "heavy" in England N.E., S.W., and the Midland Counties, and "moderate" elsewhere. Bright sunshine was less than the average in all districts except Scotland N.

Unsettled conditions again prevailed throughout the *third* week. Over a large part of England precipitation occurred every day, generally in the form of rain, but sometimes in that of sleet, snow or hail.

Over the whole week rainfall was either "heavy" or "very heavy," except in Scotland N. and W., where it was "moderate." Temperature differed little from the normal as a whole, but was a little below it in most districts. Except in Scotland N., sunshine was "scanty."

In the *fourth* week the conditions were mostly fair and dry over the eastern, southern, and south-western counties of England, but elsewhere rain was of frequent occurrence, although it was seldom heavy. Temperature was above the average, the excess being large generally and as much as 7° in England E. Rainfall was "heavy" or "very heavy" throughout Scotland, and in England N.W.; elsewhere it was generally "light." Sunshine was "abundant" in Scotland E. and England S.E., and "moderate" in other districts.

Agricultural Conditions in Great Britain in March.

The Crop Reporters of the Board, in reporting on agricultural conditions on the 1st April, state that while the very wet weather which prevailed during the first three weeks of March has often told adversely on crops of wheat on heavy and low-lying lands and discoloration is common, the wheat generally is still looking very healthy and vigorous, and is forward for the time of year. A few instances occur where the seed has perished, but as a rule there is a full plant. The area under wheat on the 1st April is estimated as being greater than last year in all parts of Great Britain, except the south-east of England, Wales, and the east of Scotland. The total area under the crop for the 1912 harvest is probably not quite 2 per cent. more than in 1911, for the country as a whole.

Winter oats and beans are usually very promising crops.

The continuous wet weather of March delayed the sowing of spring corn practically everywhere. The sunnier days and drying winds in the last week of the month much improved conditions and considerable progress was then possible on the lighter working soils, but many heavy soils were still too sodden to work at the end of the month, and spring sowings are in arrears. Those crops which were sown early, however, are coming up well.

Potato planting has also been delayed by the unfavourable conditions. In the large potato-growing districts of Lincoln the work is generally behind-hand, except in north-west Lincoln and south Kesteven. In Ayrshire and Wigtown the earlier crops are practically all set, but elsewhere in Scotland practically nothing had been done at the end of March.

Throughout the country the ewe flocks are in low condition owing to the shortage of roots and to the weather; in Scotland their condition is perhaps better than in England and Wales. The lambing season is nearly over in the southern and midland counties of England, and is in full swing in the northern counties. The fall of lambs hardly exceeds that of an average season, and in a number of districts the proportion of twins is smaller than usual. Severe losses, either of ewes or lambs, are the exception. The wet weather and lack of sunshine told against the progress of the lambs, and in a number of counties the shortage of ewes' milk kept them back, but the drier days in the last part of the month and the growth of grass in the pastures improved conditions considerably, so that the lambs are now doing fairly well, as a rule. In Scotland only a few early flocks had lambed down at the end of March.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for March, 1912, issued by the International Institute of Agriculture, gives revised figures for the production of wheat and oats in the Southern Hemisphere from information received up to March 20th.

The production of wheat in *Argentina* in 1911–12 is now estimated to be 21,172,000 qr., as against 18,243,000 qr. in 1910–11, or an excess of 16·1 per cent. The production of oats is estimated to be 6,197,000 qr., as compared with 4,839,000 qr. in the previous year, or an increase of 28·1 per cent.

The production of wheat in *New Zealand* in 1911–12 is estimated to be 889,000 qr., as compared with 1,034,000 qr. in the previous year, or a decrease of 14 per cent.; and the production of oats 2,018,000 qr., as against 1,261,000 qr. in 1910–11, an increase of 60 per cent.

The total production of wheat in *Argentina, Chili, Australia,* and *New Zealand* is now estimated to be 36,298,000 qr. in 1911–12, as compared with 34,123,000 qr. in 1910–11, or an increase of 6·4 per cent.

Planting of Winter Cereals.—The area sown to wheat in *India* last autumn was about the same as that sown in the previous autumn. Upon an area representing some 40 per cent. of the total area under wheat in the Northern Hemisphere in 1911, the area sown in the autumn of 1911 is 2·2 per cent. greater than the corresponding area of 1910.

The condition of winter cereals is reported as from average to extremely good in all European countries from which information has been received, except in Denmark, where development has been somewhat delayed by frost. On the other hand, development is rather too forward in Spain, France, and Italy, and lodging is feared. Weeds are stated to be very abundant in France and Spain.

Preparation of the ground for spring sowing is going forward under good conditions throughout Europe. There has been an abundance of moisture and warmth in most countries, and spring sowing has commenced in several.

Austria.—The production of the cereal crops in 1911 and the increase or decrease (represented by the signs + or −) per cent. as compared with 1910 are as follows:—Wheat, 7,359,000 qr., +2·3 per cent.; rye, 12,143,000 qr., −4·4 per cent.; barley, 8,927,000 qr., +10·1 per cent.; oats, 16,036,000 qr., +10·6 per cent.; maize, 1,396,000 qr., −31·1 per cent. The areas sown in 1911, compared with the areas sown in 1910, expressed as percentages, are as follows:—Wheat, 100·1; rye, 98·1; barley, 99·6; oats, 102·5; maize, 97·1.

Denmark.—The final returns of the production of the cereal crops in 1911, with increase or decrease per cent., as compared with the production in 1910, are as follows:—Wheat, 558,000 qr., −1·8 per cent.; rye, 2,299,000 qr., −1·4 per cent.; barley, 2,762,000 qr., −3·6 per cent.; oats, 5,109,000 qr., +1·9 per cent.

Italy.—The final returns of the production of maize in 1911 are given at 10,926,000 qr., a reduction of 7·9 per cent. on the production in 1910.

Portugal.—The Direcçao Geral da Estadistica states that the area under wheat in 1911 was 1,211,000 acres, with a production of 1,481,000 qr. These figures refer to Portugal proper and do not include the Azores or Madeira.

Sugar Beet.—The final returns of the production of sugar beet in Austria and Denmark in 1911 show a production for Austria of 4,181,000 tons, as against 6,948,000 tons in 1910, being a decrease of 39·8 per cent.; and for Denmark of 709,000 tons, as against 727,000 tons in 1910, a decrease of 2·5 per cent.

Germany.—The weather continues favourable, and agricultural operations are proceeding under favourable conditions. It is confirmed that considerable areas in Mecklenberg, Holstein, Pomerania, and Western Prussia sown to white wheat had to be ploughed up owing to frost damage; otherwise the condition of winter wheat is quite promising. (*Beerbohm's Evening Corn Trade List,* March 29th.)

Russia and Roumania.—The general appearance of the autumn-sown crops is reported to be favourable; in the former country some complaints are heard, more especially regarding Poland, but, with a favourable change in the weather it is thought that very little damage will be found to have been done. Spring sowings are expected to commence in the south this week. (*Beerbohm's Evening Corn Trade List,* March 29th.)

United States.—The weather has been seasonable during the past week in most districts; complaints continue to be made that in the soft winter wheat States a good deal of damage has been done during the winter, and that in these States a fairly large acreage has been winter killed. In Kansas and other States the outlook is described as very promising; the official report on the condition is usually published about April 8, but the estimate of the wheat area destroyed is not published until May. The "North-Western Miller" cables that crop conditions are promising in Kansas; in Missouri and Illinois crop prospects are improving. In the Ohio valley the crop is three weeks late. (*Beerbohm's Evening Corn Trade List,* March 29th.)

India.—The Second General Memorandum on the wheat crop of 1911–12 reports the total area sown to be 29,444,000 acres, which is slightly less than last year, but nearly 9 per cent. more than the average of the previous five years. The condition of the crop at the time of the report was good, except in Bombay, where it had suffered from deficient water supply.

New South Wales.—*Reuter's* correspondent at Sydney has cabled that the advance figures regarding the wheat harvest for 1911–12 show that the December estimates were exceeded by over a million bushels; 2,334,780 acres yielded 3,077,012 qr. of wheat. (*Dornbusch,* April 4th, 1912.)

Argentina.—The Ministry of Agriculture has issued the following

estimate of this season's area sown with maize, with a preliminary estimate of the probable yield :—

Provinces.	Area. Acres.	Yield. Tons.
Buenos Aires...	3,458,000	3,490,000
Santa Fé	2,717,000	2,200,000
Cordoba...	1,161,000	800,000
Entre Rios	197,000	152,000
Pampa Central	222,000	860,000
Other Provinces	692,000	
Total	8,447,000	7,502,000

Last year's yield did not exceed 750,000 tons, compared with 4,450,000 and 3,456,000 tons respectively in the two previous seasons. (*Dornbusch,* March 29th, 1912.)

Tasmania.—A preliminary estimate of the acreage and production of the corn, hay, and potato crops, issued by the Government Statistician, shows decreased yields per acre for each crop except potatoes, which are generally attributed to the abnormally cold, dry, and windy weather of the last months of 1911. The production of wheat is estimated at 103,316 qr., from 41,905 acres; oats, 206,605 qr., from 61,444 acres; barley, 24,055 qr., from 7,715 acres; hay, 107,924 tons, from 77,089 acres; and potatoes, 63,776 tons, from 20,573 acres.

Live Stock Census in Hungary.—A live stock census was taken in Hungary in the spring of 1911, and the results, compared with the figures of the previous census, taken in 1895, are given in the following table. The figures do not include live stock in Croatia and Slavonia :—

—	Census of		Increase (+) or Decrease (−).	
	1895.	1911.	Actual.	Per cent.
Horses	1,972,930	2,000,611	+ 27,681	+ 1·4
Asses and Mules	22,278	18,765	− 3,513	− 15·8
Cattle (including Buffaloes)	5,829,483	6,183,424	+ 353,941	+ 6·1
Sheep	7,526,783	7,696,881	+ 170,098	+ 2·3
Pigs	6,447,134	6,415,197	− 31,937	− 0·5
Goats	286,392	331,383	+ 44,991	+ 15·7

The report accompanying these returns states that although the increase in the number of cattle has not been proportionate to the increase of population, it should not be concluded that there has been a depreciation in this branch of production, for, during the last fifteen years, there has been a considerable improvement in the *quality* of the cattle. (*Bulletin of Agricultural Statistics,* March, 1912.)

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on April 1st, 1912, certain diseases of animals existed in the countries specified :—

Austria (for the period March 20th—27th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 911 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period February 16th—29th).

Anthrax, Blackleg, Foot-and-Mouth Disease (20 "foyers" in 16 "communes"), Rabies.

Bulgaria (for the period March 8th—14th).

Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Denmark (month of February).

Anthrax, Foot-and-Mouth Disease (243 cases), Swine Erysipelas.

France (month of February).

Anthrax, Blackleg, Foot-and-Mouth Disease (1,251 "étables" in 757 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period March 1st—15th).

Foot-and-Mouth Disease (3,915 infected places in 1,606 parishes), Glanders and Farcy, Swine Fever.

Holland (month of February).

Anthrax, Foot-and-Mouth Disease (90 outbreaks in 11 provinces), Foot-rot, Swine Erysipelas.

Hungary (for the period February 14th—21st).

Anthrax, Foot-and-Mouth Disease (total of 105 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period February 12th—18th).

Anthrax, Blackleg, Foot-and-Mouth Disease (63 new cases entailing 1,670 animals), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period January 15th—31st).

Foot-and-Mouth Disease (13 "étables" infected in 6 "communes"), Glanders and Farcy.

Norway (month of February).

Anthrax, Blackleg, Swine Fever.

Roumania (for the period February 29th—March 6th).

Anthrax, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of November).

Anthrax, Foot-and-Mouth Disease (24,190 animals in 625 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period February 24th—March 2nd).

Anthrax, Rabies.

Spain (month of January).

Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (114,539 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of February).

Anthrax, Blackleg, Foot-and-Mouth Disease (2 outbreaks), Swine Fever.

Switzerland (for the period March 11th—17th).

Anthrax, Blackleg, Foot-and-Mouth Disease (66 "étables" entailing 800 animals, of which 7 "étables" were declared infected during the period), Swine Fever.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in March.—

Agricultural Labour in England during March.

Outdoor employment was frequently interrupted by rain during the first three weeks of March, particularly in the more southern districts, and the demand for labourers outside the regular farm staff was consequently reduced. There was otherwise but little marked surplus in the supply of extra men, who were wanted, when the weather permitted, for such work as threshing, hedging, ditching, and carting and spreading manure. Men for permanent situations were still reported as scarce in parts of the Midland and Southern and South-Western Counties.

Northern Counties.—Rain caused a little interruption to the employment of extra labourers in some districts, but these men were, on the whole, in fair demand for such work as hedging, ditching, repairing fences, carting, and spreading manure, and threshing. The supply was generally about equal to the demand, though some surplus was reported in parts of the Bridlington, Patrington, Pickering, and Wath Rural Districts in *Yorkshire.* No general change in wages was reported at hiring fairs held during March in *Northumberland.*

Midland Counties.—Extra labourers in these counties lost a good deal of time through rain in some districts, particularly in the more southern counties. When the weather was favourable the supply of such men was generally balanced by the demand, and mention of any marked surplus was exceptional in the reports; in several districts near industrial centres, however, unemployed miners and others affected by the coal strike occasioned a surplus of labour available for agricultural purposes. Men for permanent situations were wanted in parts of the Bucklow (*Cheshire*), Evesham, Pershore, and Shipston-on-Stour (*Worcestershire*), Banbury and Crowmarsh (*Oxfordshire*), Wing (*Buckinghamshire*), and Berkhamsted (*Hertfordshire*) Rural Districts.

Eastern Counties.—There was less demand than usual for extra labourers in most districts on account of wet weather, which prevented hoeing and seed sowing, and especially affected employment in *Suffolk* and *Essex.* The partial loss of last season's root crops further reduced employment in *Norfolk,* where a surplus of extra men was reported in many districts; a similar surplus was reported in parts of the Thinghoe (*Suffolk*), and Braintree, Dunmow, and Saffron Walden (*Essex*) Rural Districts.

Southern and South-Western Counties.—During the first three weeks of the month extra labourers were generally in irregular employment owing to continuous wet weather. Apart from several districts in Kent and Hampshire, little excess of such men was reported when the weather permitted of outdoor work, the demand for labourers being chiefly for threshing, hedging, ditching, and carting and spreading manure. Men for permanent situations were reported as scarce in several districts, including parts of the Petworth (*Sussex*), Hartley Wintney (*Hampshire*), Wantage (*Berkshire*), Chippenham and Mere (*Wiltshire*), Blandford (Dorset), Bromyard (*Herefordshire*), Stow-on-the-Wold (*Gloucestershire*), Torrington (*Devonshire*), and West Penwith (*Cornwall*) Rural Districts.

THE CORN MARKETS IN MARCH.

C. KAINS-JACKSON.

Wheat.—Prices have varied singularly little, but on the whole have tended to harden. The miller has found himself perplexed over the weekly arrivals, which have not included enough hard dry glutenous wheat, while showing a superabundance of certain other kinds. Total returns of imports have been unsteady from a miller's point of view, because they have included a very much larger proportion than usual of feeding wheat, mainly from Canada. Any dry English wheat offered has sold briskly, and the average price has been about 34*s.* per 480 lb., or 35*s.* 8*d.* for the "Mark Lane quarter" of 504 lb. Many markets have been reported as dull owing to the rainy weather having put a large percentage of the fresh offerings out of condition. The finest Canadian wheat has made 44*s.* 6*d.* per qr., while there are samples still within millers' views at ten shillings less than this. The price of American red winter has averaged 8*s.* 3*d.* per cental. Australian f.a.q. and Indian choice white have reached 41*s.* per qr. each, but the last-named is the cheaper, as the buyer gets 496 lb. for the money, against 480 lb. of Australian. Imports for the seven completed months of the cereal year have been smaller than for either of the two preceding seasons, though farmers' deliveries of English wheat have been a good deal larger than for the previous season. Thus at the present moment the country is under-supplied with imported wheat in granary, and this deficiency, variously estimated at from 400,000 to 700,000 qr., is not made up by the quantity on passage, which is practically identical with what it was at the end of March, 1911, and also at the end of March, 1910. But it must be noted that the North American visible supply, including Canadian, is 14,530,000 qr., as compared with 8,480,000 qr. a year ago. This excess, being held by merchants, has a very distinct effect in checking upward tendencies in prices for early summer delivery, for it is thought that a comparatively small advance in price might lead to heavy shipments. The difference at the end of March between wheat for delivery before Easter and for "summer delivery" (in the course of July) was about sixpence per cental for American, Indian, Argentine, and Australian, but fine Canadian, Russian, and wheat from S.E. Europe were sorts by no means cheaper to this extent, and not very easy to obtain for forward delivery at all. The cessation of the great railway strike in Argentina led during the last fortnight of March to an immense exportation of grain which had been held up, but the coal strike in Great Britain introduced a new element of disturbance, and freights for April and May shipment made a most serious rise for steamers. March shipments were 565,000 qr. from North America; 1,854,000 qr. from South America; 682,000 qr. from Russia; 548,000 qr. from Europe S.E.; 541,000 qr. from India; and 828,000 qr. from Australia.

Flour.—The increased cost of grinding in the coal-run mills, which are estimated to put through 90 per cent. of the milling business, caused during the month a rise of 1*s.* to 1*s.* 6*d.* per sack in the chief sorts of flour, and of 1*d.* per 14lb. bag in the factor's price to the grocer. Shipments from Canada and the United States were below the average, and as neither Hungary nor Australia did much, the total on passage at the end of the month was less than usual of all the chief kinds. Farmers were helped by the early season, and owing to their not needing so much meal as usual, some of the rough grists were a little cheaper before the month closed. North American shipments for March were 348,000 sacks.

Barley.—The trade in English barley after February is seldom brisk, but during the past few weeks it has been of quite exceptional dullness. The imports of feeding barley have no more than satisfied inquiry, and with only 180,000 qr. on passage, against half a million qr. a year ago, trade closed with a very strong feeling, 29*s.* being about the lowest sum for which delivery of Russian in April could be secured. Indian varied from 27*s.* to 28*s.* per qr. It is only in very recent years that it has risen to importance on British exchanges, but it proves a serviceable feeding stuff, and relieves a too exclusive dependence on Russia when home supplies of grinding quality have given out. Shipments for March were 828,000 qr. from Russia, 105,000 qr. from India, and 318,000 qr. from Europe S.E.

Oats.—The excellent value commanded by British oats has been a welcome sign, both of demand for horse feed and of inquiry for fine seed corn. March, with its London horse shows, usually brings to Mark Lane buyers who insist on the best quality, and this year 24*s.* to 25*s.* per 336 lb. have been freely paid. Country averages have also been decidedly satisfactory to growers; only north of the Trent have returns been occasionally below twenty shillings. Russian oats became scarce as the month wore on, and made a guinea per 304 lb. before the close. Argentine fluctuated almost daily with the telegrams of exports, but 19*s.* per 304 lb. would probably be a fair average for the month. The price of Canadian on the 27th reached 23*s.* 6*d.* per 320 lb. for some 2,000 qr. just to hand. The extremely small supply from the Dominion this season has surprised the trade, as official returns in the late autumn disclosed a large surplus for export. March shipments were 1,200,000 qr. from South America, 21,000 qr. from Canada, 501,000 qr. from Russia, and 80,000 qr. from Europe S.E.

Maize.—The Argentine crop was ripe in the north early in March, and the in-gathering of a great harvest occupied farmers for the following four weeks. The yield is provisionally placed at 34,510,000 qr., a colossal and entirely unprecedented total. The effect on British markets has not been great, but a good quantity for future shipment direct to our ports has been contracted for at 5*s.* 7*d.*, 5*s.* 6*d.*, 5*s.* 4*d.*, and 5*s.* 3*d.* per cental, these being the terms Argentina has been willing to accept for June, July, August-September, and for October-November shipment. The spot value of ordinary round and flat maize during March has been about 6*s.* per cental. March shipments were 770,000 qr. from North America, 633,000 qr. from Russia, and 727,000 qr. from Europe S.E. The quantity of the maize on passage at the end of March was only 350,000 qr. The Argentine new crop, needing two months to dry before shipment, will not be much in evidence on our markets before July 1st. If we have a harsh period in May the demand for spot maize may easily outrun supply.

Operations for May delivery therefore seem bound to be largely in the nature of speculating on the character of the season.

Oilseeds.—By Lady Day the quantity of linseed on passage had increased to 177,000 qr., and holders of these cargoes on the high seas were willing to sell them at 60*s.* per 410 lb. for Indian, and at 57*s.* 6*d.* per 416 lb. for Argentine. These forward prices were much below spot values of 72*s.* per 416 lb. for English and Russian, and 70*s.* per 410 lb. for Indian, so that intending buyers of landed seed had every motive for holding on as long as possible. Cottonseed, in spite of the fact that there were 48,000 tons on passage, made 8*s.* 6*d.* per cwt., and was dear for the period of the season. None of the minor oilseeds offered any relief to buyers, as sesame, poppyseed, and sunflowerseed were all held for good prices, and with nothing pressed on sale even then.

Various.—Beet sugar, with its daily fluctuations at Mincing Lane, is a rather excitable trade. Value closed at 14*s.* 4*d.* per cwt. for prompt delivery. Farmers are increasing buyers of sugar, and as an ingredient in various proprietary articles it is the subject of a very large business indeed. Stocks in London are much larger than they were a year ago, so that the good price made appears to argue a large business for actual use. Rice, with 75,000 tons on passage, is in increased prospective supply, and prices for the chief feeding type are 1*d.* per cwt. down. Burma has come to the relief of an under-supplied dari market with offers to ship by steamer at seven guineas per ton c.i.f. to London. Manchurian beans at the end of the month were making 35*s.* per 480 lb. Peas varied little during March for ordinary kinds, but blue kinds were a very depressed market. Another staple which declined appreciably during the month was English red cloverseed. Both France and Canada failing to ship buckwheat as expected, we are now relying exclusively on Russia for it. The price, 29*s.* per 400 lb., is not at all excessive under the circumstances. Haricot beans of good quality having risen to high prices, are out of request for those grades, but common Rangoon at two guineas per quarter has met with a fairly steady inquiry.

THE LIVE AND DEAD MEAT TRADE IN MARCH.

A. T. MATTHEWS.

Fat Cattle.—One of the most difficult winters in living memory for both rearers and feeders of live stock has just ended, and results have not been nearly so disastrous as it was feared they might be. The extraordinary mildness of the weather has saved the situation, and enabled farmers to economise their fodder, while the supplies of cattle coming to market have been in surprisingly good condition. Shorthorns averaged 8*s.* 11*d.* for first and 8*s.* 1*d.* for second quality, against 8*s.* 9*d.* and 7*s.* 10*d.* per 14 lb. stone in February, representing, roughly, an advance of a farthing per lb. The difference in other breeds (except Welsh Runts) was smaller, but in each case there was a distinct advance. Herefords averaged 9*s.* and 8*s.* 4*d.*, against

8*s.* 11*d.* and 8*s.* 3*d.*; Devons, 8*s.* 11*d.* and 7*s.* 11*d.*, against 8*s.* 10*d.* and 8*s.*; Welsh Runts, 8*s.* 11*d.* and 8*s.* 2*d.*, against 8*s.* 9*d.* and 7*s.* 10*d.*; and Polled Scots, 9*s.* 2*d.* and 8*s.* 5*d.*, against 9*s.* and 8*s.* 4*d.* per stone. The same evenness of values at different markets which was so notable in February, continued during March, and any considerable reduction in prices for the next three months is considered very improbable, while market opinion generally is in favour of some further advance.

Veal Calves.—There has been a better demand for fat calves, and in the second and third weeks prices went up considerably, bringing the average to 9*d.* and 8*d.* per lb. for first and second quality.

Fat Sheep.—The anticipations of a scarcity of good, fairly well-fed sheep, and consequent high prices, have proved to have been well grounded, and there have been some maximum quotations during March, which have touched the highest recorded for very many years. Newspapers have reported prime small Down tegs up to 11*d.* per lb., and 10½*d.* has been officially recorded on several occasions. Some fine half-bred tegs from Lincolnshire fetched 67*s.* 6*d.* each in London market, where prices in March ruled considerably higher than the general average of the country. A good many clipped sheep have been marketed, and these have fetched from 7½*d.* to 8½*d.* per lb., though their condition has scarcely been so good as usual. Downs in the wool in about twenty English markets averaged 9½*d.* per lb. for first quality, 8½*d.* for second, and 6¾*d.* for fat ewes, while Longwools averaged 9*d.*, 7¾*d.*, and 6¼*d.* respectively. A rather unusual feature has been the comparative plenty of Scotch sheep. In ordinary seasons these generally exceed the south country sheep in value, but of late the difference has been the other way.

Fat Lambs.—So far there has not been a very large trade in fat lambs, which are, however, now being quoted in about a dozen of the larger markets. The figures show an average for the month of about 1*s.* 0¼*d.* and 11¼*d.* per lb. for first and second quality. Prices, as usual, have been much higher in northern markets.

Fat Pigs.—Bacon pigs, with a slight check in the second week, continued to harden in value, small pigs advancing on the average 3*d.* per stone, the averages being 6*s.* 10*d.* and 6*s.* 4*d.* for first and second quality.

Carcass Beef—British.—Both Scotch and English beef in the London dead-meat market was rather dearer than in February. In the second and third weeks prime Scotch short sides were worth 5*s.* per stone of 8 lb., the average for the four weeks being 4*s.* 11*d.*, with 4*s.* 9*d.* for second quality. Long sides averaged 4*s.* 7*d.* and 4*s.* 5*d.* English sides were in good request, and averaged 4*s.* 5*d.* and 4*s.* 3*d.* per stone.

Port-Killed Beef.—Deptford sides were readily taken at practically the same average prices as those of English. Very few came from Birkenhead, from which centre sides are quoted at 1*d.* per 8 lb. less money.

Chilled Beef.—Argentine chilled beef has been steady in value, the average prices being about the same as in February, viz., 3*s.* to 3*s.* 4*d.* for hindquarters, and 2*s.* 2*d.* to 2*s.* 4*d.* per stone for fores. The highest prices were touched in the third week, when hindquarters fetched up to 3*s.* 6*d.*

Frozen Beef.—The demand for frozen beef was about normal, and prices were steady all the month. New Zealand hindquarters made 2*s.* 6*d.* to 2*s.* 8*d.*, and fores 2*s.* to 2*s.* 1*d.* Argentine was, as usual, 1*d.*, and Australian 2*d.* per stone cheaper than New Zealand.

Carcass Mutton—Fresh-Killed.—There was a very considerable further advance in home-killed mutton, but even now the Central Market prices are quite out of proportion to those of the live stock markets. A large quantity of Scotch mutton has been diverted from Lancashire markets to London owing to the strike, which curtailed the demand in the industrial centres. The average price of Scotch was 5*s.* 3½*d.* and 5*s.* per stone for first and second quality, compared with 4*s.* 10½*d.* and 4*s.* 8*d.* for English tegs.

British Lamb.—A fair business has been passing in British lamb, and prices have ranged, according to quality, from 6*s.* 8*d.* to 8*s.* per 8 lb. A very few of the celebrated Down lambs from the Wallingford district were sold at fancy prices, as much as 1*s.* 6*d.* per lb. having been obtained for this special quality.

Frozen Mutton and Lamb.—Frozen mutton has continued cheap. The demand has fallen off, owing, it was said, to want of employment in East London. The best New Zealand has fetched from 2*s.* 7*d.* up to 2*s.* 10*d.* per 8 lb., and Australian and Argentine 2*s.* 2*d.* to 2*s.* 5*d.* New Zealand new season lamb has been worth 3*s.* 6*d.* to 3*s.* 10*d.*, and Australian 3*s.* to 3*s.* 4*d.* per 8 lb.

Veal.—British veal has been quiet, and prices remained very steady at 4*s.* 8*d.* to 5*s.* 4*d.* per 8 lb., according to quality, in London markets.

Pork.—The trade in pork has fluctuated between 4*s.* and 4*s.* 6*d.* per 8 lb. for best English. The minimum was reached in the last week of March.

THE PROVISION TRADE IN MARCH.

HEDLEY STEVENS.

Bacon.—The special feature of the trade during the past month has been the rapid advance in prices for nearly all American cuts. Wholesale merchants have bought fairly freely at the enhanced values, feeling sure that as soon as the labour troubles are settled a good demand may be expected from all districts, more especially as the stocks in the hands of the retail distributors are known to be very small. Very little advance has, however, been established in the case of long sides, as the arrivals from Denmark have been large, resulting in an easy market for this cut. Canadian sides have been selling at about 58*s.*, but cables at the end of the month report that hogs in that country are now commanding $8 and upwards, which brings the cost of the manufactured article when delivered in England to 65*s.*, or thereabouts.

All the American markets have shown great strength during the month, chiefly on account of the smaller arrivals of hogs and the exceptional advances which the farmers have been able to secure. During one day (March 21st) hogs at Chicago rose 40 points, and the range for the month is from $6.15 to $7.70, against $6.60 to $7.20 last year, and $9.60 to $10.90 in the abnormal year of 1910. The home trade in America is said to be good for all hog products, and the advance in prices is not likely to check the consumption, as beef and mutton are scarce and dear in that country, and are expected to remain so.

English pigs have been marketed in smaller quantities, and prices tend to be in favour of the breeders, although curers find it difficult to compete with Denmark for the finished bacon.

Cheese.—This article is dearer on the month, but the demand has not been as good as was expected, possibly on account of the coal strike. With the abnormally small stocks at all points, it was generally anticipated that best Canadians would reach 80*s.* during March, but by the end of the month prices had only advanced to 76*s.*—78*s.*, which, however, are high prices, against 60*s.*—63*s.*, the prevailing value at the same time last year.

The arrivals from New Zealand have found good markets, and 75*s.* has been paid for wholesale lines, although at the time of writing (the end of March) purchases can be made at a little less money, as holders are nervous of carrying over their stocks at the present extreme figures.

There has been some severe weather in Canada during the last few weeks, and in consequence the season will not be an early one. It is reported that the April make will not be large.

At the end of the month the estimated stock of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) was 79,000 cheese, against 125,000 at the same time last year, and 164,000 two years ago. The stock of New Zealands was 24,500 crates in London and Bristol, against 33,000 at the same time last year.

Dealers have experienced a moderate demand for English cheese, the high prices curtailing the consumption to a great extent.

Butter.—The coal strike has had a greater effect on the consumption of butter than on that of either bacon or cheese. This is not altogether surprising at a time when thousands are so short of money, and margarine is so largely sold and advertised. All wholesale dealers have found the demand dead slow, and many were anxious sellers, especially towards the latter end of the month, the result being a number of private sales at under market values. All descriptions of Colonial butter show a fall of 4*s.* to 5*s.* on the month.

The home supply has increased, as the pastures are very forward this spring, and this fact helped to depress the market, although, on the other hand, the arrivals from Australia during April will be smaller. Many members of the trade, however, hold the opinion that quotations have seen their highest for this season.

Eggs.—There has been a great change in the egg market since February, and the position of affairs has become reversed, buyers now having matters much more their own way. On account of the mild weather supplies have been much heavier and prices have dropped several shillings. There has been a good demand, as there was no accumulation of stock.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of March, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	ENGLAND.		SCOTLAND.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 2	8 5	42 1	38 5
Herefords	9 0	8 4	—	—
Shorthorns	8 11	8 1	41 1	37 9
Devons	8 11	7 11	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	9	8	9	7
Sheep:—				
Downs	9½	8½	—	—
Longwools	9	7¾	—	—
Cheviots	9½	8½	9	7¾
Blackfaced	9¼	8¼	8	7
Cross-breds	9¼	8¼	9	8
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	6 10	6 4	6 6	5 8
Porkers	7 3	6 9	6 11	6 3
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	21 3	17 11	22 19	17 19
,, —Calvers... ...	21 10	17 4	20 13	17 5
Other Breeds—In Milk ...	18 14	15 15	18 9	15 18
,, —Calvers ...	—	11 15	19 13	16 8
Calves for Rearing	2 3	1 13	3 0	2 3
Store Cattle:—				
Shorthorns—Yearlings ...	9 16	8 9	10 15	9 3
,, —Two-year-olds .	14 3	12 5	15 16	13 1
,, —Three-year-olds	17 14	15 15	16 12	14 16
Polled Scots—Two-year-olds	—	—	17 12	14 10
Herefords— ,,	16 1	14 4	—	—
Devons— ,,	14 15	13 7	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	40 1	33 4	—	—
Scotch Cross-breds ...	—	—	31 5	28 0
Store Pigs:—				
8 to 10 weeks old	15 3	12 0	18 2	13 6
12 to 16 weeks old	24 5	18 1	24 10	20 10

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of March, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—							
English	1st	61 0	61 0	62 0	59 6	61 0*	61 6*
	2nd	56 0	56 6	59 6	55 6	56 6*	57 6*
Cow and Bull ...	1st	53 6	50 6	49 0	51 6	51 6	52 0
	2nd	45 0	43 6	44 6	46 0	45 0	45 6
U.S.A. and Canadian :—							
Port Killed ...	1st	—	61 0	61 6	—	—	—
	2nd	—	56 6	59 6	—	—	—
Argentine Frozen—							
Hind Quarters...	1st	35 6	35 6	36 0	35 6	35 6	38 0
Fore ,, ...	1st	28 6	28 6	29 0	28 6	29 6	29 6
Argentine Chilled—							
Hind Quarters...	1st	46 0	45 0	46 6	46 6	47 0	48 0
Fore ,, ...	1st	32 6	31 0	32 6	31 0	33 0	34 6
Australian Frozen—							
Hind Quarters...	1st	35 0	33 0	34 6	33 0	—	35 6
Fore ,, ...	1st	29 6	26 0	28 6	26 0	—	29 0
VEAL :—							
British	1st	70 6	77 0	74 6	77 0	—	70 0
	2nd	60 6	70 0	65 6	71 0	—	—
Foreign	1st	—	—	74 6	—	76 6	70 0
MUTTON :—							
Scotch	1st	—	76 6	74 0	78 0	68 0	70 6
	2nd	—	71 0	70 0	74 0	60 0	63 0
English	1st	72 6	68 0	68 0	73 0	—	—
	2nd	60 6	62 6	65 6	68 0	—	—
Argentine Frozen ...	1st	34 0	34 0	33 0	34 0	33 0	32 0
Australian ,, ...	1st	32 6	31 0	31 6	31 0	—	31 0
New Zealand ,, ...	1st	—	—	39 0	—	—	—
LAMB :—							
British	1st	—	—	109 6	—	—	—
	2nd	98 0	—	95 6	—	—	—
New Zealand ...	1st	54 0	51 6	54 0	52 0	—	56 0
Australian	1st	46 0	43 6	45 6	43 6	—	43 6
Argentine	1st	45 0	43 0	43 6	43 0	43 6	43 6
PORK :—							
British	1st	60 6	62 6	60 0	65 6	53 0	58 6
	2nd	56 0	51 6	55 6	60 6	47 0	55 6
Foreign	1st	—	—	57 6	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6...	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
„ 13...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
„ 20...	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
„ 27...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3...	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
„ 10..	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
„ 17...	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
„ 24...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
„ 9...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
„ 16...	32	6	30	1	34	0	23	6	24	11	31	2	18	0	17	6	21	8
„ 23...	32	9	30	2	34	1	23	7	25	0	31	10	17	11	17	5	21	9
„ 30...	33	0	30	3	34	4	23	8	24	11	30	3	18	0	17	5	21	8
Apl. 6...	33	6	30	4	34	10	23	1	24	7	30	9	17	11	17	7	21	11
„ 13...	33	7	30	3			23	5	25	2			18	3	18	3		
„ 20...	33	7	30	4			23	0	25	5			18	3	17	10		
„ 27...	33	0	30	11			22	10	25	5			18	3	18	3		
May 4...	32	6	31	4			22	7	25	7			18	2	18	6		
„ 11...	32	1	31	8			22	0	25	1			18	1	19	0		
„ 18...	31	10	32	6			21	8	25	4			17	8	19	2		
„ 25...	31	3	32	8			21	4	25	0			17	10	19	5		
June 1...	30	2	32	5			21	8	24	10			17	10	19	5		
„ 8...	29	1	32	4			20	9	25	7			17	10	19	7		
„ 15...	29	0	32	3			18	11	23	11			18	0	19	8		
„ 22...	29	4	31	11			20	1	23	9			17	9	19	10		
„ 29...	29	9	31	10			19	11	24	5			17	7	19	9		
July 6...	30	4	32	1			19	5	25	10			17	4	19	9		
„ 13...	31	1	32	3			21	3	25	10			17	7	19	11		
„ 20...	31	11	32	5			19	9	24	3			17	5	19	5		
„ 27...	33	5	32	5			20	10	23	8			18	1	19	7		
Aug. 3...	33	9	32	0			20	5	24	4			18	3	18	2		
„ 10...	33	5	31	6			20	4	26	9			18	0	18	0		
„ 17...	32	11	31	6			20	11	27	8			17	11	17	10		
„ 24...	32	7	31	8			20	10	28	10			17	2	18	0		
„ 31...	32	2	31	7			22	10	28	4			17	2	18	3		
Sept. 7...	31	11	31	10			23	3	28	4			17	2	18	1		
„ 14...	30	11	32	0			24	3	29	0			16	6	18	5		
„ 21...	30	2	32	4			24	2	29	11			16	3	18	9		
„ 28...	30	1	32	6			24	4	30	5			16	4	19	1		
Oct. 5...	30	1	32	7			24	7	30	9			16	3	19	5		
„ 12...	30	2	32	9			25	1	31	0			16	2	19	10		
„ 19...	30	4	32	9			25	3	31	5			16	1	19	11		
„ 26...	30	4	33	1			25	4	31	7			16	2	20	6		
Nov. 2...	30	4	33	4			25	6	31	10			16	2	20	8		
„ 9...	29	11	33	4			25	4	32	7			15	11	20	11		
„ 16...	29	8	33	1			25	1	32	10			16	1	21	0		
„ 23...	29	11	33	0			24	10	33	5			16	4	20	10		
„ 30...	30	6	32	10			24	7	33	10			16	7	20	11		
Dec. 7...	30	9	32	9			24	3	34	0			16	9	20	9		
„ 14...	30	7	32	11			23	9	33	5			16	10	20	9		
„ 21...	30	7	32	9			23	10	33	5			16	9	20	8		
„ 28...	30	5	33	0			23	9	33	4			16	9	20	7		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1911.	1912.	1911.	1912.	1911.	1912.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	February	46 11	45 9	26 6	29 4	21 11	23 2
	March	46 5	46 7	26 8	29 8	21 11	23 5
Paris:	February	47 5	47 4	25 7	29 0	23 6	24 7
	March	47 0	48 6	24 8	29 0	22 8	24 6
Belgium:	January	32 9	34 5	23 8	29 7	19 2	23 10
	February	32 4	35 2	24 1	30 3	19 2	24 6
Germany:	January	41 2	44 7	27 10	36 2	21 5	26 11
	February	40 9	45 1	28 4	36 7	21 9	27 9
Berlin:	January	43 2	45 3	—	—	20 11	27 0
	February	42 7	45 6	—	—	21 4	27 9
Breslau:	January	38 3	40 2	27 2* 22 11†	32 10* 28 0†	19 8	25 2
	February	38 1	40 4	27 7* 22 11†	32 10* 28 6†	19 10	25 11

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of March, 1911 and 1912.

—	Wheat.		Barley.		Oats.	
	1911.	1912.	1911.	1912.	1911.	1912.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London	31 7	34 10	24 4	35 3	18 6	23 2
Norwich	30 1	33 11	24 1	31 3	17 8	21 9
Peterborough	29 4	33 5	24 5	30 7	16 9	21 8
Lincoln	29 6	33 4	25 5	0 6	17 9	21 7
Doncaster	28 10	33 3	26 0	30 5	17 4	21 3
Salisbury	29 4	33 10	23 5	33 4	16 10	21 7

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of March, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	17 0	16 0	—	—	15 9	14 3	16 6	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	130 0	126 0	128 0	125 0	—	—	—	—
,, Factory ...	120 0	114 0	120 0	114 0	—	—	—	—
Danish ...	—	—	138 0	136 0	139 0	135 6	135 0	—
French ...	—	—	—	—	149 0	145 0	—	—
Russian ...	129 6	126 6	—	—	126 6	124 0	130 0	—
Australian ...	127 0	124 6	126 6	124 0	126 6	122 6	126 6	123 0
New Zealand	130 6	128 6	129 0	127 0	128 6	126 0	129 6	126 0
Argentine ...	126 6	125 6	125 6	123 0	124 6	122 0	128 6	124 0
CHEESE:—								
British —								
Cheddar ...	96 0	84 0	90 0	86 0	96 0	90 0	80 0	78 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	82 0	75 0	91 0	81 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	76 6	75 0	76 0	74 0	76 6	75 6	76 6	—
BACON:—								
Irish	64 0	59 0	64 6	59 0	68 6	64 0	62 0	—
Canadian ...	58 0	56 6	57 0	55 0	58 0	55 6	59 0	57 0
HAMS:—								
Cumberland ...	—	—	—	—	100 6	90 0	—	—
Irish	—	—	—	—	96 6	90 0	90 0	88 0
American (long cut)	54 0	50 6	55 0	52 0	57 6	53 0	56 0	—
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	9 7	8 4	—	—	10 0	9 2	—	—
Irish	9 4	8 10	9 0	8 3	9 8	8 4	8 10	8 2
Danish ...	—	—	—	—	9 7	8 4	9 1	8 1
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
Edward VII.	95 0	85 0	65 0	60 0	83 6	75 0	—	—
Langworthy ...	90 0	80 0	85 0	80 0	95 0	85 0	63 6	58 6
Up-to-Date ...	86 0	75 0	61 6	60 0	82 0	72 6	55 0	50 0
HAY:—								
Clover ...	115 0	105 0	120 0	104 6	122 0	100 0	95 6	88 6
Meadow ...	110 0	100 0	—	—	116 6	94 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	119	83	325	261
Animals attacked	128	99	356	301
Foot-and-Mouth Disease :—				
Outbreaks	—	1	—	1
Animals attacked	—	18	—	18
Glanders (including Farcy) :—				
Outbreaks	24	13	47	52
Animals attacked	60	29	105	184
Parasitic Mange :—				
Outbreaks	428	—	1,516	—
Animals attacked	852	—	3,555	—
Sheep-Scab :—				
Outbreaks	30	46	143	280
Swine-Fever :—				
Outbreaks	307	240	790	513
Swine Slaughtered as diseased or exposed to infection ...	3,497	2,661	9,808	5,731

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	—	—	1	3
Animals attacked	—	—	1	3
Glanders (including Farcy) :—				
Outbreaks	—	1	—	1
Animals attacked	—	1	—	1
Parasitic Mange :—				
Outbreaks	7	12	27	33
Sheep-Scab :—				
Outbreaks	50	43	208	202
Swine-Fever :—				
Outbreaks	31	12	52	35
Swine Slaughtered as diseased or exposed to infection ...	221	207	413	666

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Utah Agricultural Experiment Station.—Bull. 114:—The Movement of Nitric Nitrogen in Soil and its relation to "Nitrogen Fixation." (179–194 pp.) Logan, Utah, 1911. [576.83.]

Newsham, J. C.—Farm Institutes in Relation to Agricultural Education. (20 pp.) [Journal of the Farmers' Club, January, 1912.] [374.9.]

Memoirs of the Geological Survey, England and Wales.—The Geology of the Country around Tavistock and Launceston. (146 pp. + iii. plates.) London: E. Stanford, 1911. 3*s.* [55:912.]

Rural Education Conference.—Report on the Consolidation of Rural Elementary Schools. [Cd. 6055.] (13 pp.) London: Wyman & Sons, 1912. 2*d.* [372.]

United States Bureau of Education.—Bull. 1911, No. 2:—Opportunities for Graduate Study in Agriculture in the United States. (16 pp.) [37(73).] Supp. to Bull. 1911, No. 2:—Undergraduate or Collegiate Courses in Agriculture in the State Colleges of Agriculture in the United States. (13 pp.) [37(73).] Washington, 1911.

North of Scotland College of Agriculture.—Leaflet 13:—Report on the Field Trials and Demonstrations in Morayshire and Nairnshire in 1910. (12 pp.) Aberdeen, n.d.

King, F. H.—Farmers of Forty Centuries or Permanent Agriculture in China, Korea, and Japan. (441 pp.) Madison, Wisconsin: Mrs. F. H. King, 1911. $2.50. [63(5).]

Sowerby, John E., Johnson, C., and *Johnson, C. P.*—British Poisonous Plants. (76 pp. + xxxii. plates.) London: J. Van Voorst, 1861. [63.25.]

Kanngiesser, F.—Vergiftungen durch Pflanzen und Pflanzenstoffe. Ein Grundriss der vegetalen Toxikologie für praktische Aerzte, Apotheker und Botaniker. (49 pp.) Jena: Gustav Fischer, 1910. [63.25; 58.11.]

Field Crops—

Bangor, University College of North Wales.—Bull. III., 1911:—Varieties of Oats and Potatoes. (4 pp.) [63.314; 63.512(04).] Bull. IV., 1911:—Growth of Lucerne. (4 pp.) [63.33(c).] Bangor, 1912.

Kansas Agricultural Experiment Station.—Bull. 178:—Effect of Common Mill Fumigants on the Baking Qualities of Wheat Flour. (155–207 pp.) Manhattan, 1911. [63.294; 664.6.]

Horticulture—

Illinois Agricultural Experiment Station.—Circ. 154:—The Home Vegetable Garden. (32 pp.) Urbana, Illinois, 1911. [63.51.]

Rhode Island State College.—Extension Bull., Vol. I., No. 4:—Children's School and Home Gardening. (100 pp. + xix. plates.) Rhode Island, 1911. [63.5(07).]

British Columbia, Dept. of Agriculture.—Bull. 33:—Fruit-Growing Possibilities of Skeena River and Porcher Island Districts. (19 pp.) Victoria, B.C., 1911. [63.41(71).]

North of Scotland College of Agriculture.—The School Garden. (47 pp.) Aberdeen, 1911. [63.5(07).]

Oregon Agricultural Experiment Station.—Bull. 111:—Orchard Management. (96 pp.) Oregon, 1911. [63.42.]

Plant Diseases—

Illinois Agricultural Experiment Station.—Bull. 151:—Some Important

Insects of Illinois Shade Trees and Shrubs. (461–529 pp.) Urbana, Illinois, 1911. [63.27–49.]

U.S. Dept. of Agriculture, Bureau of Entomology.—Tech. Series, No. 23, Part I.:—Some New California and Georgia Thysanoptera. (24 pp. + vii. plates.) [59.57.] Circ. 143:—Insect Damage to Standing Timber in the National Parks. (10 pp.) [63.27–49.] Washington, 1912.

University of Leeds.—Bull. 82:—Cabbage-Top in Swedes. (21 pp. and plates.) Leeds, 1912. [63.27.] [Deals chiefly with the Swede Midge, which is shown to be the principal cause of the disease.]

California Agricultural Experiment Station.—Bull. 218:—California Plant Diseases. (1039–1193 pp.) [63.24(04).] Bull. 220:—Fumigation Studies No. 5—Dosage Tables. (33 pp.) [63.294.] Bull. 222:—The Red or Orange Scale [*Chrysomphalus aurantii*]. (99–150 pp.) [63.27.] Bull. 223:—The Black Scale [*Saissetia oleæ*, Bern.]. (151–200 pp.) [63.27.] Sacramento, 1911.

Bangor, University College of North Wales.—Bull. V., 1911:—Potatoes, Effect of Spraying. (4 pp.) Bangor, 1912. [63.24–33.]

British Columbia, Dept. of Agriculture.—Bull. 34:—Fruit-Trees and Black-Spot Canker. (14 pp.) Victoria, B.C., 1911. [63.24–41.]

Deutsche Landwirtschafts-Gesellschaft.—Pflanzenschutz. [Fünfte, vermehrte Auflage]. (304 pp. + ix. plates.) Berlin: Paul Parey, 1910. [63.29(02).]

Live Stock—

Crepin, Joseph.—La Chèvre: Son Histoire, Son Élevage Pratique, Ses Bienfaits, Ses Services. (339 pp.) Paris: Hachette & Cie., 1906. [63.63.]

Villebresme, Le Vicomte M. de.—L'Élevage en Europe et en Amérique. (655 pp.) Paris: Lucien Laveur, 1910. [63.6.]

Lydekker, R.—The Ox and its Kindred. (271 pp.) London: Methuen & Co., 1911. 6*s*. [59.9; 63.62.]

California Agricultural Experiment Station.—Bull. 219:—Report on Live Stock Conditions in Imperial County, California. (1194–1229 pp.) Sacramento, 1911. [63.6(73).]

Pennsylvania Agricultural Experiment Station.—Bull. 112:—Beef Production in Pennsylvania. (16 pp.) Pennsylvania, 1911. [63.62.]

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Circ. 186:—The Army Remount Problem. (103–124 pp. + v. plates.) Washington, 1911. [63.6(73); 63.61.]

Wyoming Agricultural Experiment Station.—Bull. 92:—The Value of Fibre Testing Machines for Measuring the Strength and Elasticity of Wool. (23 pp.) Laramie, Wyoming, 1912. [63.761.]

Dairying and Food, General—

Sadler, J.—Milk Standards. (21–40 pp.) [Journal of the Farmers' Club, February, 1912.] London: Wyman & Sons, 1912. 6*d*. [614.32.]

Local Government Board.—Reports on Public Health and Medical Subjects, New Series, No. 56:—On an Inquiry as to Condensed Milks; with special reference to their use as Infants' Foods. (64 pp.) London: Wyman & Sons, 1911. 6*d*. [614.32; 63.715.]

Savage, W. G.—Milk and the Public Health. (459 pp.) London: Macmillan & Co., 1912. 10*s*. net. [614.32; 63.71.]

Veterinary Science—

Illinois Agricultural Experiment Station.—Bull. 152:—Contagious Abortion of Cows. (529–543 pp.) Urbana, Illinois, 1911. [619.2(*a*).]

Penberthy, Prof.—The Present Position of the Tuberculosis Question. (99–133 pp.) [Journal of the Farmers' Club, December, 1911.] [614.5.]

Bibby's Book on Milk, Section IV.—Bovine Tuberculosis: Cause, Cure, and

Eradication. (459 pp. + xxiii. plates.) Liverpool: J. Bibby & Sons, n.d. 10*s.* net. [614.5.]

U.S. Dept. of Agriculture.—Farmers' Bull. 473:—Tuberculosis: A Plain Statement of Facts Regarding the Disease, Prepared Especially for Farmers and others Interested in Live Stock. (23 pp.) [614.5.] Farmers' Bull. 480:—Practical Methods of Disinfecting Stables. (16 pp.) [614.4; 63.6: 69.] Washington, 1912.

U.S. Dept. of Agriculture, Bureau of Animal Industry.—State Sanitary Requirements Governing Admission of Live Stock. (23 pp.) [614.9(73).] Bull. 145:—*Trypanosoma Americanum*, A Common Blood Parasite of American Cattle. (39 pp.) [59.169(*a*).] Washington, 1912.

British Columbia, Dept. of Agriculture.—Bull. 32:—Control of Bovine Tuberculosis in British Columbia. (52 pp.) Victoria, B.C., 1911. [614.9(71); 614.5.]

Wyoming Agricultural Experiment Station.—Bull. 91:—The Relation of the Sheep-Tick Flagellate (*Crithidia melophagia*) to the Sheep's Blood. (16 pp.) Laramie, Wyoming, 1911. [59.169(*b*).]

Royal Commission on Vivisection.—Sixth Report. [Cd. 6112.] (6 pp.) 1*d.* Appendix to Sixth Report. Further Papers, 1906–1910. [Cd. 6113.] (24 pp.) 3*d.* Final Report. [Cd. 6114.] (139 pp.) 1*s.* 3*d.* London: Wyman & Sons, 1912. [614.22.]

Kansas Agricultural Experiment Station.—Bull. 173:—*Meningo-Encephalitis* (Blind Staggers). (235–251 pp.) Manhattan, 1910. [619.1.] [A disease of horses caused by eating mouldy maize.]

Netherland Dept. of Agriculture, Industry and Trade.—Official Testing of Breeding Cattle destined for Exportation from the Netherlands. (20 pp.) The Hague, 1909. [614.9(492).]

Birds, Poultry, Bees, &c.—

*Collections Zoologiques du Baron Edm. de Selys Longchamps.**—Catalogue Systematique et Descriptif. Fasc. III.:—Embiidinen. (121 pp. + iv plates.) 38.50 Fr. [59.57.] Fasc. XIII.:—Libellulinen. (529–700 pp. and plates.) 46 Fr. [59.57.] Brussels, 1911.

India, Memoirs of the Dept. of Agriculture, Entomological Series.—Vol. III.:—The Food of Birds in India. (371 pp.) Calcutta, 1912. Rs. 7-8. [59.162.]

British Columbia, Dept. of Agriculture.—Bull. 28:—Production of Eggs. (12 pp.) 1911. [63.651.] Bull. 29:—The Poultry Industry on the Pacific Coast. (14 pp.) 1910. [63.65(73).] Bull. 30:—Guide to Bee-Keeping in British Columbia. (52 pp.) 1910. [63.81(04).] Victoria, B.C.

Zander, Dr. E.—Handbuch der Bienenkunde in Einzeldarstellungen. III.—Der Bau der Biene. (182 pp. + xx. plates.) Stuttgart: Eugen Ulmer, 1911. M. 5. [63.81(02).]

Kansas Agricultural Experiment Station.—Bull. 180:—Bacteriological Studies on Eggs. (333–396 pp.) Manhattan, 1911. [576.8; 63.74.]

Forestry—

Vorträge über Pflanzenschutz der Abteilung für Pflanzenkrankheiten des Kaiser Wilhelms-Instituts für Landwirtschaft in Bromberg.—Zweites Heft:—Forstschutz. (94 pp.) Berlin: Paul Parey, 1911. 1.60 M. [63.49–2.]

India.—Forest Bull. 6:—Memorandum on the Oil Value of Some Sandal Woods from Madras. (11 pp.) 3*d.* [63.49–197; 63.493.] Forest Bull. 7:—Note on the Chemistry and Trade Forms of Lac. (20 pp.) 4*d.* [63.49–197.] Calcutta: Superintendent Government Printing, 1911.

Sierra Leone, Forest Officer.—Report on Forests of Sierra Leone. (35 pp.) London: Waterlow and Sons, 1911. [63.49(6).]

Indian Forest Records.—Vol. II., Pt. IV.:—Host Plants of the Sandal Tree. (159–207 pp. + viii plates.) Calcutta: Superintendent Government Printing, 1911. 3*s*. [63.493.]

Weber, Dr. Rudolf.—Lehrbuch der Forsteinrichtung. (440 pp.) Berlin: J. Springer, 1891. 13.20 M. [63.49(021).]

Cross, C. F., Bevan, E. J., and *Sindall, R. W.*—Wood Pulp and its Uses. (270 pp.) London: Constable and Co., 1911. 6*s*. net. [674; 676.]

U.S. Dept. of Agriculture, Forest Service.—Circ. 196:—The Influence of Age and Condition of the Tree upon Seed Production in Western Yellow Pine. (11 pp.) Washington, 1912. [63.492.]

Canada, Dept. of the Interior, Forestry Branch.—Bull. 24:—Wood-using Industries, 1910. Agricultural Implements and Vehicles, Furniture and Cars, Veneer. (42 pp.) [63.49(71); 674.] Bull. 25:—Forest Products of Canada, 1910—Lumber, Square Timber, Lath and Shingles. (39 pp.) [63.49(71).] Bull. 26:—Forest Products of Canada, 1910. Pulpwood. (14 pp.) [63.49(71).] Bull. 27:—Forest Products of Canada, 1910. Tight and Slack Cooperage. (11 pp.) [63.49(71).] Ottawa, 1911.

Bowman, Isaiah.—Forest Physiography. Physiography of the United States and Principles of Soils in Relation to Forestry. (759 pp. + plates and maps.) New York: J. Wiley and Sons, 1911. [63.49(73); 63.49–11.]

Graves, H. S.—The Principles of Handling Woodlands. (325 pp.) New York: John Wiley and Sons, 1911. $1.50 net. [63.49–19.]

Laschke, Carl.—Geschichtliche Entwickelung des Durchforstungsbetriebes in Wissenschaft und Praxis. (114 pp.) Neudamm: J. Neumann, 1902. [63.49(021); 63.49(43).]

Samitca, E. R.—Notes sur la Conservation des Traverses en Hêtre par l'Imprégnation Économique et spécialement par le Procédé Rüping. (77 pp. + 32 plates.) Paris: H. Dunod et E. Pinat, 1911. 6 fr. [63.49–198; 63.491.]

Cuif, E.—Influence des Éclaircies dans les Peuplements Réguliers de Sapin. (120 pp.) Paris: Lucien Laveur, 1905. [63.49(04); 63.492.]

Engineering—

India, Memoirs of the Dept. of Agriculture, Chemical Series.—Vol. II., No. 2:—Records of Drainage in India. (63–140 pp.) Calcutta, 1912. Re. 1. [63.14.]

Economics—

Eve, H. Trustram.—Agricultural Land and Local Taxation. (55–78 pp.) [Journal of the Farmers' Club, May, 1911.] [336.28.]

Baverstock, A. H.—The English Agricultural Labourer. (vii. + 56 pp.) London: A. C. Fifield, 1912. 6*d*. net. [331.]

Gonner, E. C. K.—Common Land and Inclosure. (461 pp. and 5 maps.) London: Macmillan & Co., 1912. 12*s*. net. [333.1.]

Italy, Ministero di Agricoltura, Industria e Commercio.—Annali di Agricoltura, 1911, No. 267:—Le Associazioni Zootecniche in Italia e All' estero. (cxxii. + 421 pp.) Rome, 1911. [334(06); 63.6(06).]

U.S. Dept. of Agriculture, Bureau of Statistics.—Circ. 29:—Foreign Crops Summary. Area and Production of Cereals, 1907–1911, and of Flaxseed, 1908–1910, by Countries. (18 pp.) Washington, 1912. [63.31:31; 63.34111.]

Board of Trade.—Report on Trade Unions in 1908–1910. [Cd. 6109.] (cii. + 143 pp.) London: Wyman & Sons, 1912. 1*s*. [331.]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P5. 37 & 45. 6,000. 4/12. R. C. & S., Ltd.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE

Vol. XIX. No. 2.

MAY, 1912.

HOP GROWING ON THE PACIFIC COAST OF AMERICA.

ARTHUR AMOS, M.A.,
Department of Agriculture, Cambridge University.

*History of Production in the United States.**—Hop growing first became of commercial importance in the United States about the year 1850. At this time the crop was naturally confined to the Eastern States, of which New York at once took the lead, and, as shown in the table on the next page, produced in 1849 over 20,000 cwt. out of a total crop of 30,000 cwt. The lead, which New York then obtained, was steadily maintained till in 1879 the New York acreage had increased to 39,000 acres, with a crop of 193,000 cwt., or more than four-fifths of the total United States production of that time. In these early days the only other hop-growing States of importance were Wisconsin, Michigan, and, for a time, Vermont.

Since this time, 1879, the production of hops in New York and the other Eastern States has steadily declined, and at the last census, taken in 1909, New York alone of the Eastern States was producing a significant quantity, and the area and production even in New York had declined to 12,000 acres and 77,000 cwt. respectively.

The same period, 1870-79, which witnessed the summit of New York State's fame as a hop-producing state also marked the initial stage of the crop in the states of the Pacific Coast. Of these states, California at first took the lead, but in 1899 the census showed that Oregon had both a larger area and production than either of its rivals, California and Washington, being second only to New York State. The last census, taken in 1909 and recently published, shows that the Pacific Coast States now easily hold the premier position, both Oregon and California producing greater crops than New York State. (See table above.)

---

* The facts under this heading are taken chiefly from figures obtained and published at each decennial census, and collected in Bulletin No. 50 of the Bureau of Statistics of the U.S. Dept. of Agriculture, entitled: "Hops in Principal Countries with Statistics of Beer Brewing."

TABLE I.

Area and Production of Hops in the four principal Hop-growing States.

	New York.		Oregon.		California.		Washington.	
Date.	Area.	Production.	Area.	Production.	Area.	Production.	Area.	Production.
	acres.	cwt.	acres.	cwt.	acres.	cwt.	acres.	cwt.
1849	4,000	22,000	0	0	0	0	0	0
1859	15,000	86,000	0	0	0	0	0	0
1869	30,000	157,000	—	87	—	5,500	—	55
1879	39,000	193 000	300	2,000	1,100	13,000	500	6,000
1889	36,700	179,000	3,100	32,000	4,000	58,000	5.100	74,000
1899	27,500	155,000	15,400	131.000	6,900	90,000	5,300	61,000
1909	12,000	77,000	21,000	139,000	8,400	107,000	2,400	36,000

The reason for this transference of the hop-growing area is not difficult to find, the rich soil of the river valleys on the Pacific Coast combined with an exceptional climate being responsible for the change, and whereas the average crop of New York State varies from 5 to 8 cwt. per acre, that on the Pacific Coast varies from 8 to 15 cwt. per acre.

In more recent years the history of the increase in the acreage on the Pacific Coast is the more interesting because of its relation to the general state of depression of the hop industry throughout the world. During the years 1902, 1903, and 1904 the hop-growers, especially in Oregon, made good profits, and in 1904 these profits were augmented by the pool which was formed in England, as a result of which 147,000 cwt. of hops were shipped from America to England at very remunerative prices. The consequence was that during 1903, 1904, and 1905 fully 10,000 acres of hops were planted in Oregon alone. The year 1906 was a favourable year for hops, and upon the increased acreage a very large crop was produced, with the result that the market was swamped, and prices fell below the cost of production. In 1907 and 1908 the effects of the low price of hops were so seriously felt on the Pacific Coast that an agitation was started in favour of increasing the tariff on imported hops, and in a pamphlet entitled "Hop-growing in the United States—A Dying Industry" it was shown by a misleading selection of figures that whilst in the four principal hop-growing States—New York, California, Oregon, and Washington—the production had declined from 36 to 65 per cent. during the years 1895 to 1908, the production in Germany and Austria-Hungary had increased in the year 1908 by 51 per cent. over the mean production of 1900–1904. It is hardly necessary to add that in 1908 a heavy crop was produced in Germany and Austria, whilst in the United States the crop was far below the normal. The result of the agitation was that the duty on hops imported into the United States was increased from 12 cents to 16 cents (*6d.* to *8d.*) per pound.

As a result of the low prices the acreage of hops on the Coast, especially in Washington, was considerably reduced during the three years 1907, 1908, and 1909, but not by any means to the same extent as in England and Germany. In 1910 and 1911 the acreage remained stationary, however, and in view of the present high price of hops, it is certain that large areas will have been planted in Oregon and California this season.

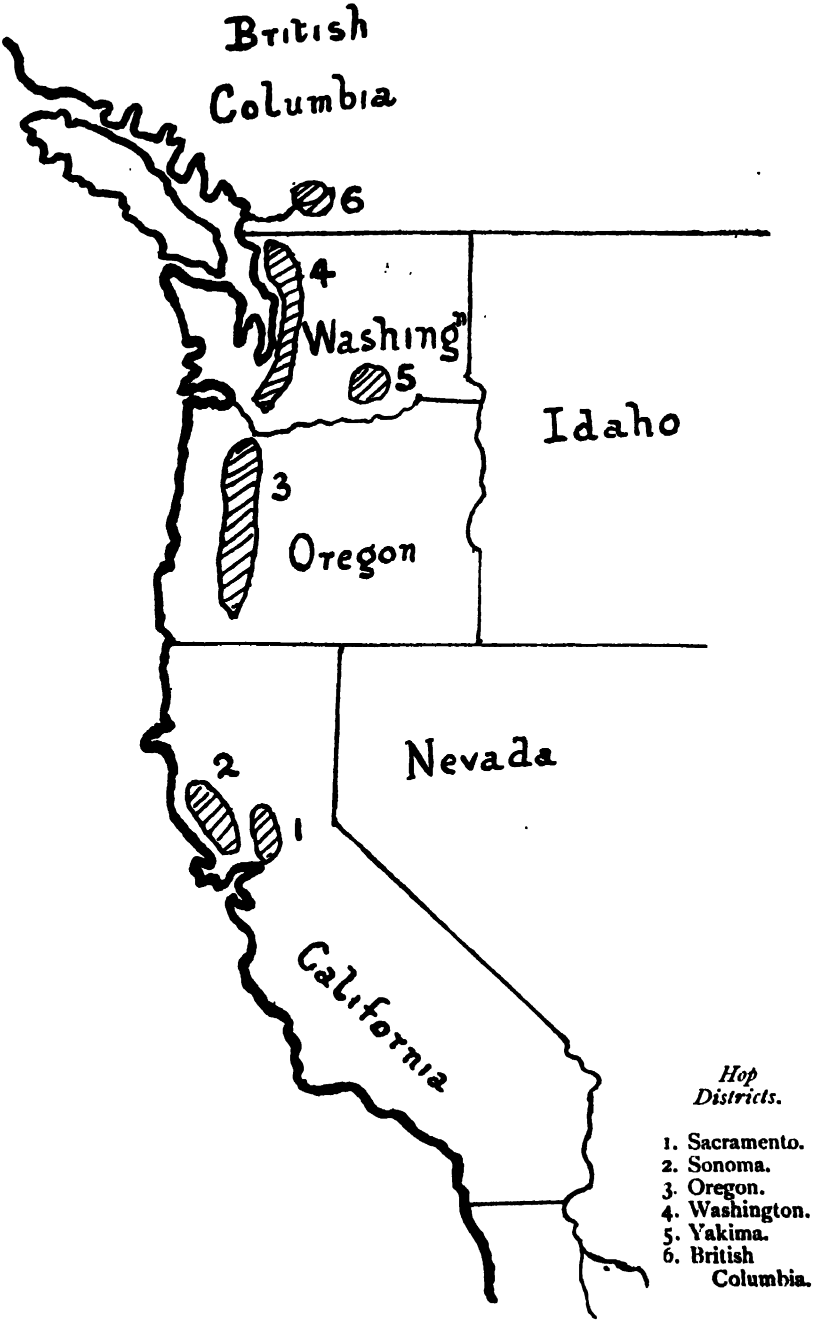
In New York State the crop last year was a very poor one, and it is probable that the acreage in this State will steadily decline.

Climate and Distribution.—On the Pacific Coast the hop-yards are for the most part collected in well-defined areas, situated in the river valleys. The areas lie comparatively near the Pacific Coast, and receive an average rainfall of from 20 to 40 inches. The bulk of this rain falls within the six winter months from November to April. The four summer months from June to September are characterised by dry weather, and even in Oregon and Washington the average rainfall does not amount to more than one inch per month, whilst in California rain is very exceptional.

In California there are two main hop-growing districts—the Sacramento and Sonoma districts. The former comprises about 5,000 acres, lying in the valley and close to the banks of the Sacramento River and its tributaries, the American, Cosumnes and Bear Rivers. This district lies about 100 miles from the Pacific Coast in one of the hottest parts of California, shade temperatures during the summer months frequently rising to between 100° and 110° F. In this district commencement of growth is usually somewhat delayed, and little growth is made by the hops until well into May, although the spring weather is mild and favourable to growth. This state of affairs is probably explained by the fact that the winters are also mild, and thus the plants do not receive the stimulus of severe wintry weather. When growth has once started, however, it is exceedingly rapid, and hops are ripe and ready to pick early in August.

The Sonoma district also comprises about 5,000 acres. It occupies the same degree of latitude, but being situated much nearer the coast, does not experience such intense summer heat; in consequence of this, hops do not ripen in this district until the end of August. The greater part of this district lies in the valley of the Russian River and extends from Santa Rosa in the south to Ukiah in the north.

In Oregon, there are at the present time about 20,000 acres of hops situated in one large district running north and south about 70 miles from the coast and lying for the most part in the valley of the Willamette River. In Oregon the climate is cooler than in California, and the rainfall is considerably larger, amounting on the average to from 30 in. to 40 in. per year. Owing to the cooler weather and the moister atmosphere, the hop aphis is more troublesome in Oregon than in California, and washing has to be carried out to a small extent. The hop-yards in Oregon may be divided into two classes: (1) the "valley" yards, comprising all those yards which are situated on low-lying ground close to the Willamette River. These are well supplied with subsoil moisture, and produce large crops of hops; (2) the "prairie" yards, which are situated farther from the river upon the



MAP SHOWING THE POSITION OF THE CHIEF HOP-GROWING DISTRICTS OF THE PACIFIC COAST OF AMERICA.

higher levels. These, owing to their situation, do not obtain the same good moisture conditions as the "valley" yards, and in consequence produce much smaller crops, averaging, in fact, only 5 cwt. per acre.

In Washington the hop-yards are more scattered than in either Oregon or California. One district extends along the coast with a climate similar to that of Oregon. Its central market is Portland. Another district is situated much farther inland in a part of the country known as the "dry belt." This district lies in the valley of the River Yakima, and is known as the Yakima district. The average rainfall here is less than 10 in. a year, and consequently irrigation has to be practised in order that the hop roots may obtain sufficient moisture for the growth of the plant. In these two Washington districts there are together about 3,000 acres of hops.

In British Columbia hop-growing is now confined to a very small area—probably the total area does not amount to more than 800 acres. Hops were first introduced into British Columbia about the year 1890. In 1900 the area grown had increased to 262 acres. From this date until 1906 and 1907 there was a rapid increase in the area, which amounted probably to over 2,000 acres. The hops produced were of good quality, and those grown from English roots had a character very similar to that of the best English hops. In 1903 the hop flea-beetle began to be observed in the hop-yards, and it increased to such an extent that in 1908 it was estimated that the British Columbian crop was reduced 75 per cent. by its ravages, and one large grower informed me that his hops cost him about 2s. per lb. to produce in that year. For some years no remedy could be found for this pest, and this fact, together with the low range of prices, resulted in the grubbing of many gardens.

At the present time the bulk of the hops is grown at Chilliwack and Agassiz in the valley of the Fraser River. The climate in this region is mild and humid, and resembles the climate of Kent and Worcester in England.

Formerly a few hops were grown in the Okanagan Valley, which also lies in the "dry belt," but, with the exception of 50 acres on the Coldstream ranch, these have now been grubbed. In the Okanagan valley conditions are similar to those in the Yakima Valley, and irrigation is essential.

General Conditions.—On the Western Coast of America many agricultural businesses are conducted on a large scale, and hop-growing is no exception. It is not by any means uncommon to see 100 acres in one yard, and in the Sacramento Valley I saw a hop-yard of over 500 acres in one piece, belonging to Messrs. Durst, whilst Messrs. E. Clemens Horst & Co. have hop-yards in California, Oregon, and British Columbia amounting to several thousand acres. Whilst, however, a considerable proportion of the Pacific Coast hops are grown upon this huge scale, there are also a large number of growers farming between 5 and 50 acres of hops.

The size of the yards is naturally determined by the "lie of the land." In the Sacramento Valley, where the country is flat and open, small yards and small growers are the exception. In Sonoma, where the country is more confined, most of the yards are small. In Oregon small and large growers are fairly evenly divided. In the east, in New York State, the hop-yards are invariably small.

Growers.—Wherever hops are cultivated there must always be a great element of speculation attaching to their growth, because of the large fluctuations in price. Probably nowhere is this element of speculation so prominent as upon the Pacific Coast, where growers are always prepared to "take a chance." Cases are not wanting where a man, starting with nothing, has made a fortune with his hops in a few years, which fortune he has lost again in an equally short time at the same business. So long as prices of hops are high and prospects are good, the banks are ready to advance money to the growers for current expenses, but in times of depression and low prices, growers are unable to obtain advances from the banks. In these circumstances a grower in need of money is forced to go to some local dealer, who will only advance the money upon the grower signing a contract at ruinous prices. This was the state of affairs during the period of low prices in 1908, at which time many small growers contracted their hops at 6*d*., and even 5*d*. per lb. for three or four years, and in the Sonoma district I met one or two unfortunate growers who still had such contracts to run.

This method of disposing of hops by contract is much more readily carried out on the Pacific Coast than in England, since the hops are not subject to such great variation in quality.

Tenure of Land.—The conditions under which the land is held upon the Pacific Coast are somewhat different from those in England. In the first place a far greater proportion of the hop-growers own their own land, in some districts 50 per cent. and in others 75 per cent. of the hop-growers either owning their land or having an option on it. Those who have an option are much in evidence. A man wishing to start hop-growing may have insufficient capital to buy the farm outright, so he obtains an option on the land, by which he is enabled to buy the land at a certain price, payment being extended over a number of years. This practice seems to answer its purpose very well.

The remainder of the hop-land is farmed by tenants, the majority of whom do not pay a fixed rent, but pay instead a crop rent, usually one-quarter or one-fifth of the crop, depending upon the hop prospects. If prospects are good the rent is one-quarter of the crop, if poor only one-fifth. This is high when compared with English standards, for if the crop averages 11 cwt. per acre, at a value of £5 per cwt., the rent amounts to £13 15*s*. per acre when the rent is one-quarter of the crop. Again, even if the price is only £3 per cwt., and the rent fixed at one-fifth of the crop, the rent amounts to £6 12*s*.

Comparatively few farms are held at a fixed rent.

Labour.—Perhaps the one factor which is the most difficult to control in the cultivation of the Pacific Coast hops is that of labour. The reason for this is threefold. In the first place, much of the labour is only needed during part of the year, from February, when a start is made in cutting the string into the required lengths, until the end of September. During the four months from October to January, there is very little work for the hand labourer, and in fact many of the hop-yards are partially flooded for days at a time. Secondly, the cost of all manual labour on the West Coast is very high, amounting to between 6*s*. and 10*s*. per day. Thirdly, in a sparsely populated country it is a matter of considerable difficulty to obtain adequate labour for picking.

This last difficulty is rendered less acute by the fact that the native Indians participate in hop-picking and practically in no other form of labour, and by the recent introduction of the hop-picking machine, which, although in use only on Messrs. Horst & Co.'s yards, yet displaces hand labour for picking from a considerable area. I learn that during the picking season of 1911 labour was very plentiful, partly owing to this reason, but especially owing to a large influx of labour from the Eastern States.

The labour employed in the hop-yards may be sharply divided into two classes: (1) horsemen or teamsters; (2) field labourers.

(1) Horsemen or teamsters are the men who tend and work with the horses, or mules, the latter of which are largely used in the Sacramento Valley, since they are able to withstand the scorching sun better than horses. The teamsters are almost invariably of North European descent. As a matter of experience it is found that neither the Latin races of Europe nor Asiatic races work satisfactorily with horses. The teamsters, for the most part, are constantly employed throughout the year, although they do not on this account refrain from "quitting" at a moment's notice with or without good reason for doing so, but as a rule they are reliable men. Each man works with a team of two horses, which he always drives with reins.

(2) Just as the teamsters are taken almost entirely from one class of labour, so also are the field labourers, who are almost entirely Japanese, Chinese, and Hindus. For this type of work the white man is too independent, even the Italians and Greeks, who form a large proportion of the unskilled labourers engaged in railway construction, mining, &c., in California, being very rarely employed.

The Japanese are probably the most numerous of the labourers employed in the hop-yards; they are extremely persevering and industrious so long as they are working by contract, and literally keep hard at work from daylight to dark, but they require to be closely supervised, or the work is slurred over. They are but rarely employed at daywork for the reason that so long as the interests of growers and labourers coincide the Japanese labourer is industrious, but when this is not the case, he is inclined to be idle. As a general rule, the Japanese work in gangs under a "boss," who makes the contract and receives the pay, which he in turn distributes.

The Chinese have the reputation of being the most reliable of all the agricultural labourers on the Pacific Coast. They are industrious and conscientious, and do nearly as much work per day when employed by the day as by the piece. Again, as a general rule, the contract work of the Chinaman is well done. There seems to exist a certain sympathy between the Chinaman and his crops which induces him to do the work thoroughly. I well remember watching one Chinaman pruning hop hills with as much care as if they could feel the cuts he was making. This reputation is so pronounced that a Chinaman in contracting to perform the manual work in a hop-yard for the season, can frequently obtain two or three dollars (=8*s*. to 12*s*.) per acre more than a Japanese.

In some parts of the coast Hindus are numerously employed in the hop-yards. They are neither so industrious as the Japanese nor so trustworthy as the Chinese, and may be said to occupy a medium position between the two latter in these respects. They always work under a "boss" or head man of their own class, who as a rule does a good business by taking a percentage of each man's wages as his perquisite. The Hindus are frequently employed by the day, since they dislike contract work. Some difficulty occasionally arises on account of differences of caste among the Hindus, which necessitates separate sleeping and cooking places for each.

Owing to the high cost of manual labour, which amounts to from 6*s*. to 10*s*. per day, according to season and district, every effort is made in the matter of organisation and the use of labour-saving machinery to reduce the need for this to a minimum. For example, every garden is arranged so that horse cultivation can be carried out in both directions; and every kiln is supplied with some device for elevating the green hops to the drying floor.

(*A continuation of this article will appear in a subsequent number of the Journal.*)

THE LIME-SULPHUR WASH FOR USE ON GOOSEBERRIES.

E. S. SALMON, F.L.S.

Mycologist to the South-Eastern Agricultural College, Wye, Kent.

THE Lime-Sulphur Wash is at the present time one of the most extensively used fungicides in the United States. In that country commercial preparations of the wash in concentrated form have been placed on the market by firms of repute for many years past; the same kind of factory-made preparation of a guaranteed specific gravity is now being put on our market by makers in this country, and there is every probability that the lime-sulphur wash will be given an extensive trial as a summer fungicide by fruit-growers during the next few years.

The importance of the use of this wash as a fungicide against apple and pear "scab" is not considered in this article, which deals with the possibility of its use on gooseberries.

It may be pointed out that a need for a new fungicide exists in connection with the control of the American gooseberry mildew. When the "summer-stage" of this mildew begins to appear in May or June, the disease will, under favourable weather conditions, spread through a plantation at a rapid rate (just as the closely-related hop "mould" does through a hop-garden), unless spraying with an effective fungicide is carried out. It has been well established by scientific experiments that a wash made of "liver of sulphur" (polysulphides of potassium) is thoroughly efficacious in killing the mildew in the "summer stage," and so preventing its spread, but in order to achieve this result the wash has to be applied every ten days (or oftener in wet weather) throughout the growing period of the gooseberry bush. As the weather is very frequently showery at the time when the mildew is appearing, the repeated spraying with the "liver of sulphur" wash (which is removed by rain) necessary to prevent the disease spreading, becomes an operation too expensive for the commercial gooseberry-grower. A sulphur wash which is not readily washed off by rain is required.

So far as I am aware no experiments have been carried out in the United States with the object of ascertaining the "strength" (specific gravity) at which the lime-sulphur wash can be used with safety on gooseberry foliage. On apple leaves the strength generally recommended is a specific gravity of about 1·01.

A few experiments on bushes growing in the fruit plantations at Wye College were carried out in 1910. During May a considerable number of bushes of "Whinham's Industry" and "Berry's Early" were thoroughly sprayed with the wash at sp. gr. 1·01. No injury resulted. On June 4th the use of the wash at the same strength on bushes of "Yellow Rough" resulted in very serious injury, the bushes being almost completely defoliated.

On June 21st bushes of "Whinham's Industry" were heavily sprayed with the wash at sp. gr. 1·01 and at sp. gr. 1·005. Some scorching occurred in both cases, and a considerable number of leaves fell off.

On June 21st a plot of 39 bushes of the varieties "Berry's Early," "Whinham's Industry," and a few "Lancashire Lad" were thoroughly sprayed with the wash at two strengths, sp. gr. 1·005 and sp. gr. 1·003. The plot was divided into two parts; one part with 13 bushes was sprayed with the 1·005 sp. gr. wash; the other part, with 26 bushes, with the 1·003 sp. gr. wash. Both parts of the plot contained bushes of the three varieties. The bushes of "Lancashire Lad" sprayed with the 1·005 wash, as well as those sprayed with the 1·003 wash, were seriously injured, and after a few days lost practically all their leaves; no injury resulted to "Berry's Early" or "Whinham's Industry."

During the season of 1911 the following experiments were carried out on gooseberry bushes growing in one of the fruit-plantations at Wye College. Mr. D. Eyre Baxter—then a student at the College studying mycology—co-operated in the work, doing the actual spraying, and keeping a record of any injury caused by the wash, and also a diary of the general weather conditions.

The object of the experiments was to ascertain at what strength (specific gravity) the lime-sulphur wash can be used on the foliage of the gooseberry from May to September without causing injury. The lime-sulphur wash was used at the following strengths:—

(1) Specific gravity ... ... 1·005
(2) " " ... ... 1·0025
(3) " " ... ... 1·001

The first variety of gooseberry sprayed was "Whinham's Industry," a variety extensively cultivated in North Kent and other parts of that county. Three bushes were sprayed with the wash at each of the strengths indicated above, making nine bushes at each spraying. The spraying was done approximately every fortnight, from the end of May to the beginning of September, fresh bushes being used for each spraying. Each bush was thoroughly sprayed, using the Vermorel "Éclair Étamé" knapsack sprayer; ¾ gallon of the wash was used on the three bushes, which were four years old. The bushes were closely observed each day after they had been sprayed, for about a fortnight, with the object of noting what leaf-fall, if any, occurred, and at what date. A daily record of the general weather conditions was kept to ascertain if there was any connection between them and the susceptibility of the foliage to injury.

In the case of "Whinham's Industry" there was no leaf-fall throughout the whole experiment extending from May to September, notwithstanding the exceptional amount of brilliant sunshine and the abnormally high temperatures that prevailed during the summer.

(When this non-susceptibility to injury of "Whinham's Industry" became apparent, a series of sprayings was started with the lime-sulphur wash at a higher concentration, viz., 1·01 sp. gr. Three bushes were sprayed on July 21st, August 21st, and September 5th, fresh bushes being used on each occasion. There was a very slight leaf-fall from the bushes sprayed on August 21st, but not enough to cause any appreciable injury, while there was no leaf-fall from the bushes sprayed at the other two dates.)

Exactly the same treatment as that described above in the main set of experiments with "Whinham's Industry" was given during the same period to an equal number of bushes (four years old) of "Berry's Early." Very different results were obtained. On this variety, *under certain weather* *conditions,* serious injury occurred, resulting in a severe defoliation of the shoots of the bushes. The results obtained are tabulated below. The leaf-fall was ascertained by actual counting of the fallen leaves.

If we take the Table on p. 103 and average the percentages of the leaves that fell from the three bushes at each spraying, we obtain an estimate of the amount of injury liable to be caused to "Berry's Early" by the lime-sulphur wash:—

Average total leaf-fall from the shoots of the sprayed bushes.

Experiment.	1·005 sp. gr.	1·0025 sp. gr.	1·001 sp. gr.
	%	%	%
No. 1	22·5	12·4	17·1
" 2	3·8	3·6	2·3
" 3	0·8	1·4	1·4
" 4	5·2	6·5	2·9
" 5	16·0	9·9	7·8
" 6	3·7	2·7	1·8
" 7	15·9	9·6	7·9

With the wash at 1·005 sp. gr. serious injury occurred in three instances, viz., in Experiments Nos. 1, 5, and 7. If, as would probably be the case, more than one spraying were required to protect the bushes from mildew, such injury as this might be serious enough to preclude the use of the wash. (It is to be noted that in some instances the wash at a lower strength caused more leaf-fall than at a higher strength, *e.g.*, in Experiment No. 1 the wash at 1·001 sp. gr. caused 17·1 per cent. of the leaves of the shoots to fall, while the wash at 1·0025 sp. gr. caused 12·4 per cent. of the leaves to fall.)

On the other hand, in three cases, in Experiments Nos. 2, 3, and 6, the injury was much less severe, not severe enough to prevent the use of the lime-sulphur wash if it were proved that the wash at the strength used is an effective fungicide.

Now if we compare the weather conditions that obtained at the time of the three sprayings in Experiments Nos. 1, 5, and 7 with those that obtained at the time of the three sprayings in Nos. 2, 3, and 6, we obtain evidence which seems to indicate that *the amount of injury inflicted is dependent upon certain weather conditions.* In the three instances where serious injury was caused, the weather con-

LEAF-FALL ON "BERRY'S EARLY" SPRAYED WITH LIME-SULPHUR WASH.

Bush No.	(1). 1·005 sp. gr.			(2). 1·0025 sp. gr.			(3). 1·001 sp. gr.			Sprayed.	Weather conditions.
	Leaf-fall commenced.	Period of fall.	Percentage of leaves fallen from shoots.	Leaf-fall commenced.	Period of fall.	Percentage of leaves fallen from shoots.	Leaf-fall commenced.	Period of fall.	Percentage of leaves fallen from shoots.		
1	June 2	8 days	25·6	June 2	8 days	12·8	June 2	10 days	15·1	May 26	May 26—June 8. Scorching sun with breeze; some rain on June 3.
2	,, 2	8 ,,	15·3	,, 2	8 ,,	5·2	,, 2	8 ,,	21·2	,, 26	
3	,, 2	8 ,,	26·5	,, 2	10 ,,	19·2	,, 2	8 ,,	14·9	,, 26	
1	,, 17	11 ,,	3·5	,, 17	11 ,,	2·9	,, 17	11 ,,	2·1	June 9	June 9 — 20. Chiefly cool, cloudy and rainy; very little sunshine.
2	,, 17	11 ,,	6·3	,, 17	11 ,,	4·6	,, 17	11 ,,	2·3	,, 9	
3	,, 17	11 ,,	1·7	,, 17	11 ,,	3·3	,, 17	11 ,,	2·5	,, 9	
1	,, 27	1 ,,	0·2	,, 27	1 ,,	0·6	,, 28	3 ,,	1·7	,, 21	June 21—July 1. Cool, with rain, then warmer, but cloudy. July 2—7. Scorching sun.
2	,, 29	2 ,,	1·9	,, 27	4 ,,	1·4	,, 27	4 ,,	2·0	,, 21	
3	,, 27	1 ,,	0·3	,, 27	4 ,,	2·1	,, 27	2 ,,	0·6	,, 21	
1	July 9	9 ,,	4·1	July 9	9 ,,	6·0	July 9	—	0	July 7	July 7—20. Very hot most of time, with breeze. Shower of rain on July 15.
2	,, 9	9 ,,	5·0	,, 9	9 ,,	6·1	,, 9	9 ,,	5·1	,, 7	
3	,, 9	9 ,,	6·6	,, 9	8 ,,	7·4	,, 9	6 ,,	3·5	,, 7	
1	,, 24	12 ,,	13·6	,, 24	12 ,,	13·1	,, 24	12 ,,	10·9	,, 21	July 21 & 22. Scorching sun. July 23—26. Cool; rain. July 27—Aug. 4. Scorching sun.
2	,, 24	12 ,,	12·9	,, 24	12 ,,	8·2	,, 24	12 ,,	7·1	,, 21	
3	,, 24	12 ,,	21·5	,, 24	12 ,,	8·4	,, 24	12 ,,	5·4	,, 21	
1	Aug. 25	1 ,,	1·0	Aug. 31	8 ,,	1·5	Sept. 2	6 ,,	1·8	Aug. 21	Aug. 20. Severe thunderstorm. Aug. 21. Rain; dull, subsequently dull and warm. Hot on Sept. 6 and 7.
2	,, 26	12 ,,	8·6	,, 26	12 ,,	3·1	,, 2	6 ,,	1·4	,, 21	
3	Sept. 1	7 ,,	1·6	,, 26	12 ,,	3·4	Aug. 26	12 ,,	2·3	,, 21	
1	,, 8	5 ,,	19·6	Sept. 8	5 ,,	10·3	Sept. 8	5 ,,	8·5	Sept. 5	Sept. 5. Warm; bright. Sept. 6—8. Scorching sun. Sept. 9. Cool; cloudy. Sept. 10 & 11. Hot. Sept. 12 & 13. Cooler; dull.
2	,, 8	5 ,,	14·2	,, 8	5 ,,	8·5	,, 8	5 ,,	7·5	,, 5	
3	,, 8	5 ,,	14·0	,, 8	5 ,,	10·0	,, 8	5 ,,	7·8	,, 5	

ditions at the time of spraying and soon afterwards were as follows:—Nos. 1 and 5, "scorching sun"; No. 7, "warm and bright" to "scorching sun." In the three instances where little injury was caused, the weather conditions were as follows:—No. 2, "chiefly cool, cloudy and rainy"; No. 3, "cool, then warmer, but cloudy"; No. 6, "rainy and dull."

The results generally would seem to indicate that it is not safe in very hot sunny weather to use the lime-sulphur wash even at "half strength" (1·005 sp. gr.)—or indeed at the lower concentrations—on such varieties as "Berry's Early." "Yellow Rough" may be expected to show a similar susceptibility. The susceptibility shown holds good as regards both the young foliage in May and the old leaves in September.

On the other hand, in cool or cloudy weather, such as we usually have in this country at the time of year when the mildew is first beginning to spread for the season by means of the *spores* formed in the "summer stage," the lime-sulphur wash diluted to 1·005 sp. gr. may safely be used on such varieties as "Berry's Early."

The results of a separate experiment showed the same association of a marked leaf-fall with very hot weather. In this experiment three bushes of "Berry's Early" were sprayed with the 1·005 sp. gr. wash on July 4th; three fresh bushes were similarly sprayed on July 10th. The weather conditions at the respective dates were as follows: July 4th to July 8th, "scorching sun, with strong breeze"; July 10th to July 14th, "cloudy." The average total leaf-fall that resulted on the bushes on the two occasions was as follows: July 4th, 18·7 per cent.; July 10th, 5·2 per cent.

A few experiments were carried out with the object of discovering what effect, if any, *shading* the bushes would have. On July 3rd three bushes of "Berry's Early" were shaded by means of matting held over them by poles. This was done overnight, so that the bushes should not be exposed to the direct rays of the sun until the spraying had been done. The spraying was carried out during the morning of the next day, July 4th, and the shading was removed as soon as the wash had dried on the leaves. The strength of the wash used was 1·005 sp. gr. On the same morning three bushes of the same variety which had not been shaded previously were similarly sprayed, and were then shaded as soon as the spray had dried.

As controls, three bushes were sprayed under natural conditions in the open. The weather conditions at the time were as follows: July 4th to July 8th, "scorching sun." The same experiment was attempted on July 10th, but unfavourable conditions for the experiment supervened, the weather conditions on July 10th (when the actual spraying was done) being "cloudy" (*i.e.*, with *occasional* sunshine), "with breeze."

The results obtained are tabulated below.

Method of treatment of bushes.	Sprayed July 4.			Sprayed July 10.		
	Percentage of leaves which fell from shoots.			Percentage of leaves which fell from shoots.		
	1	2	3	1	2	3
Shaded overnight and through the next day until sprayed; exposed after spray had dried	23·2	43·7	29·2	2·5	1·5	4·6
Sprayed in sun and shaded as soon as the spray was dry	17·7	17·5	15·4	5·6	4·5	6·6
Sprayed in sun and left exposed ...	11·3	18·9	25·9	4·1	5·0	6·6

In the first spraying on July 4th the average total leaf-fall from bushes shaded until the spray had dried was 32·0 per cent., as against 16·9 per cent. from the bushes sprayed in sunshine and shaded as soon as the spray was dry, and 18·7 per cent. from the bushes sprayed under natural conditions in the open.

The effects of shading, or absence of direct sunlight, have to be considered in two directions, viz., on the vegetable cell and also on the possible lengthening of the time of drying on the wash, and the chemical changes involved. Data with regard to both points require to be collected.

Conclusions.—(1) It appears safe, under any weather conditions, to spray "Whinham's Industry" with the lime-sulphur wash at 1·005 sp. gr. Probably it is safe under most weather conditions to spray this variety with the wash at 1·01 sp. gr.

(2) It is unsafe, during very hot weather, or if very hot weather is expected, to spray "Berry's Early" (and probably "Yellow Rough") with the lime-sulphur wash at 1·005 sp. gr. (or even at a lower concentration), as serious defoliation will result.

(3) In dull warm weather, and in sunny weather if it is not exceptionally hot, it appears safe to spray "Berry's Early" with the lime-sulphur wash at 1·005 sp. gr., as only very slight defoliation will result.

It is clear that the different varieties of gooseberries cultivated commercially differ as regards their susceptibility to injury from the lime-sulphur wash. For the present—until further experiments have been carried out—the "half-strength" wash at 1·005 sp. gr. should be used, the "full-strength" wash at 1·01 sp. gr. being tried only on an experimental scale.

THE FEEDING OF FARM STOCK.

CHARLES CROWTHER, M.A., Ph.D.
Leeds University.

PART IV.—RATIONS FOR DAIRY COWS AND OTHER CATTLE.*

In the following pages typical rations for different kinds of stock are given, together with practical hints on the special requirements and peculiarities of each class.

DAIRY COWS.

In dealing with the general principles involved in the feeding of milk-yielding animals (Vol. XVIII., p. 990) it was pointed out that the amount of food required by a cow yielding milk may be regarded as made up of two portions, viz.:—

(*a*) Food required for maintenance (see Vol. XVIII., p. 903). This will be roughly proportional to the live-weight of the animal;

(*b*) Food required to sustain the production of milk. This will be roughly proportional to the weight of milk produced.

---

* This part of the article is largely based upon Leaflet No. 79, but much new matter has been included.

The needs of a dry cow (*i.e.*, the maintenance requirements of a cow) will be adequately met by a ration supplying daily about ·6 lb. of digestible albuminoids and 6 lb. starch-equivalent per 1,000 lb. live-weight.

According to the best experiments and the data obtained in well-conducted milk-record societies, the production of 10 lb. (say 1 gallon) of milk requires that the ration shall be increased by about ·6 lb. of digestible albuminoids and 2·5 lb. starch-equivalent. On this basis we arrive at the following as the "standard" requirements, or "typical rations," of dairy cows * that are fed solely for milk-production :—

Rations per 1,000 lb. Live-weight per Day.

Yield of Milk.	Total Dry Matter.	Digestible Albuminoids.	Starch Equivalent.	Digestible Oil.	Digestible Carbohydrates, and Fibre.
lb.	lb.	lb.	lb.	lb.	lb.
10	25	1·2	8·0	0·3	10
20	27	1·8	10·5	0·5	12
30	29	2·4	13·0	0·6	14
40	31	3·0	15·5	0·8	15

The basis upon which the above graduation of the rations in accordance with the milk-yield has been arrived at is not strictly accurate, but is quite precise enough for practical purposes. The amount of coarse fodder included in the ration may range from 14 lb. to 21 lb. per day.

The amount of digestible oil may with advantage be ½ lb. to ¾ lb. per day (per 1,000 lb. live-weight), but nothing appears to be gained by supplying greater quantities.

The daily ration of a cow giving about two gallons of milk should contain about 7 oz. of lime and 5 oz. of phosphoric acid. These amounts will usually be covered by the ration, especially if it includes a fair proportion of good hay or green food.

In the case of cows that are to be sold fat when dry ("feeding for milk and beef"), the supply of digestible albuminoids may be gradually reduced as the milk-yield falls, until the daily ration (per 1,000 lb. live-weight) contains about 2¼ lb., but the starch-equivalent should be maintained at about

---

* The typical rations given throughout these pages are based upon the feeding standards recently drawn up by Kellner. In each case, unless otherwise stated, the quantities given represent rations per 1000 lb. live-weight per day. The table might have been limited to Total Dry Matter (as measure of desirable bulk), Digestible Albuminoids, and Starch Equivalent, but the other data have been added here and elsewhere in the following pages for the convenience of those readers who prefer to have the requirements stated in terms of albuminoids, oil, and carbohydrates.

14½ lb. This adjustment may be effected by changing the concentrated foods in the ration, replacing those first used by others with wider albuminoid ratios.

In-calf cows will require, during the last five months before calving, a rather more liberal supply of albuminoids than is indicated in the above "standards" (say ·2 lb. more), in order to provide for the growth of the fœtus. The feed should be cooling and mildly laxative in character. During the last two months the proportion of coarse fodder, especially straw, should be reduced somewhat, in order to diminish the risk of any undue pressure upon the uterus. The needs of a dry cow near calving-time will be adequately met by a ration supplying (per 1,000 lb. live-weight) about ¾ to 1 lb. of digestible albuminoids and 6½ to 7 lb. starch-equivalent.

The following points of general application should also be borne in mind in connection with the feeding of dairy cows:—

(1) The diet should not be monotonous; occasional changes of food during a long winter are advantageous, but these changes should be effected gradually.

(2) Swedes, turnips, cabbage, rape, kohl rabi, mangolds, carrots, and parsnips all afford suitable green or succulent winter food for cows. For practical purposes these foods are much alike in nutritive qualities, though parsnips, carrots, and moderate-sized mangolds are rather superior to the rest. Cabbages, carrots, and mangolds are probably the best where first-rate butter is desired, care being taken, in the case of cabbage, to remove the dead and bruised leaves before feeding. To prevent tainted dairy produce all roots and green food, including silage, should be given immediately after milking. Potatoes, either raw or steamed, are a suitable food for cows; they are much richer in carbohydrates than the other foods named. Raw potatoes should not be given near calving-time.

(3) A mixture of two or more concentrated foods is usually more serviceable and more economical than one foodstuff alone. In selecting the concentrated foods, due regard must be had to their possible influence upon the flavour of the milk, or more particularly the flavour, appearance, and texture of the butter. The following foodstuffs, if used liberally, have a softening tendency upon the butter-fat:—

rice-meal, maize, oats, wheat bran. On the other hand, a hardening influence is exercised by beans, peas, cotton cakes and meals, and cocoanut cake. These effects are only appreciable when the foodstuffs in question are used liberally, and may be avoided by using appropriate mixtures of foods from each class. Musty, mouldy, or otherwise damaged food should be avoided as far as possible, or objectionable taints may easily be imparted to the milk. So far as the influence of the food upon the flavour of the milk and butter is concerned, good pasturage stands unrivalled; carrots are probably the best of the root crops, oats the best of the cereal grains, and rice-meal or maize germ meal the best of the cereal offals.

(4) The water-supply should be adequate and of good quality.

(5) Cows should either be allowed access to rock-salt, or salt should be mixed with the food (about 1 oz. per head per day).

(6) Cow-houses should be kept at a temperature of about 56° to 58° F. The ventilation should be ample, but not such as to give rise to cold draughts. It is better for the general health of the cows that the byre shall be cool and well ventilated rather than warm at the expense of ventilation. The milk-yield will not suffer, as a rule, unless the cows experience actual discomfort from exposure to chilly draughts.

WINTER RATIONS FOR DAIRY COWS.

The following are specimen winter rations for dairy cows, classified according to the type of farm for which each is best adapted. These and other rations throughout the article are given merely as examples, and should be modified to suit special circumstances such as the supply and value of the hay, straw, roots, and corn available, and the prices of the various concentrated feeding-stuffs that are suitable for the purposes of the ration.

In drawing up the rations the animal kept in mind has been the cow weighing about 11 cwt.—say a shorthorn of average size—and giving two gallons (20 lb.) of milk per day. Such a cow will require a ration per day of about 12 lb. starch-equivalent, including 2 lb. of digestible albuminoids. For cows giving more (or less) than two gallons of milk, the allowance of concentrated foods should be increased (or reduced) at the rate of about 2 to 3 lb. for each gallon of milk. As a rule, the amount of any one oil-cake or similar meal included in a ration should not exceed 4 or 5 lb., or 3 to 4 lb. where butter is made.

For each hundredweight live-weight above (or below) 11 cwt. the ration should be increased (or decreased) by about 2 lb. of hay or 3 lb. of straw, or such amount of other foods as will supply about ·1 lb. digestible albuminoids and ·7 lb. starch-equivalent.

(I.) *Farm largely Arable.*

On such a farm roots and straw will be abundant and hay comparatively scarce. The rations apply in general where such conditions prevail.

(a). *Where Milk is Sold.*

1.—56 lb. Swedes
21 ,, Oat Straw
2½ ,, Crushed Oats or 2¼ lb. Crushed Wheat
4 ,, Decorticated Cotton Cake *

2.—56 lb. Swedes
16 ,, Oat Straw
4 ,, Crushed Oats
3¾ ,, Decorticated Cotton Cake

* Soy-bean cake may in all cases be substituted for decorticated cotton cake.

3.—56 lb. Swedes
14 ,, Oat Straw
3 ,, Oats
2 ,, Cocoanut Cake or Bean Meal
3 ,, Decorticated Cotton Cake

(b). *Where Butter is Made.*

4.—35 lb. Mangolds or 28 lb. Carrots
21 ,, Oat Straw
4½ ,, Crushed Oats
4 ,, Decorticated Cotton Cake

5.—42 lb. Swedes or 30 lb. Cabbage
21 ,, Oat Straw
4 ,, Crushed Oats or Rice Meal
3¾ ,, Decorticated Cotton Cake

6.—28 lb. Carrots or 35 lb. Mangolds
18 ,, Oat Straw
2 ,, Crushed Oats
2 ,, Maize Germ Meal } or 5 lb. Bean Meal +
3¾ ,, Decorticated Cotton Cake } 1½ lb. Soy Bean Cake

Rations 1, 2, and 3 would contain too liberal an allowance of swedes to make good butter. Nos. 2 and 3 are specially adapted for a light-land arable farm where turnips would be largely grown but the straw would be short in growth. Nos. 4 and 6 might be used after the New Year, when the swedes are finished and the mangolds ripe. They would be suitable also for a farm growing plenty of straw, and mangolds and carrots rather than swedes. In all the rations a heavy allowance of straw is included, but in certain cases it might prove necessary to reduce the quantity and adjust the ration accordingly.

(II.) *Farm half Arable.*

On a half arable farm, one foddering of hay a day could probably be spared for the cows, but only a moderate allowance of roots and straw.

7.—35 lb. Swedes
7 ,, Hay
14 ,, Oat Straw
2½ ,, Maize Meal or 3 lb. Crushed Oats
3¾ ,, Decorticated Cotton Cake

8.—28 lb. Swedes
7 ,, Hay
14 ,, Oat Straw
3 ,, Cocoanut Cake
2½ ,, Bean Meal
3 ,, Undecorticated Cotton Cake

9.—28 lb. Mangolds
7 ,, Hay
14 ,, Oat Straw
3 ,, Maize or 3½ lb. Barley Meal
3¾ ,, Decorticated Cotton Cake

10.—42 lb. Swedes
7 ,, Hay
14 ,, Oat Straw
5 ,, Dried Grains
2¼ ,, Decorticated Cotton Cake

11.—28 lb. Mangolds
7 ,, Hay
10 ,, Oat Straw
4 ,, Wheat Bran
6 ,, Bean Meal

No. 8 would suit a farm having but few swedes for consumption, and No. 9 is adapted for spring feeding.

No. 11 consists of foods which are largely grown on clays or clay-loams, and is therefore well adapted for use on strong-land farms, while it has the merit of not necessitating the purchase of any imported food. On the other hand, it supplies little fat (·35 lb.), and might be improved in this respect by the substitution of 1 lb. of crushed soy beans for 1 lb. of the ordinary bean meal.

(III.) *Farm about one-third Arable.*

12.—28 lb. Swedes or Mangolds or 21 lb. Cabbages
14 ,, Hay
7 ,, Oat Straw
3 ,, Maize
3 ,, Decorticated Cotton Cake

13.—28 lb. Swedes
14 ,, Hay
7 ,, Oat Straw
3 ,, Crushed Oats
2 ,, Undecorticated Cotton Cake
2 ,, Decorticated Cotton Cake

(IV.) *Grass Farms.*

14 —21 lb. Mangolds
28 ,, Hay
2½ ,, Decorticated Cotton Cake

15.—28 lb. Hay
3¾ ,, Bran
1 ,, Wheat Meal
1¼ ,, Decorticated Cotton Cake

16.—28 lb. Hay
5 ,, Dried Grains
1½ ,, Bran
¼ ,, Treacle

17.—28 lb. Hay
1 ,, Maize, Barley, or Wheat Meal
1½ ,, Pea Meal
1¼ ,, Decorticated Cotton Cake
½ ,, Linseed

In the case of No. 15 a portion of the hay might be chaffed, mixed with the bran, moistened with hot water, and served in two meals. In preparing No. 16 the treacle should be dissolved in 1 gallon of hot water, mixed with the grains and bran and served the next day.

In the case of No. 17 one gallon of boiling water should be poured on the linseed at night, the meals and the cake being stirred in next day just before serving, with the addition of a little salt.

In reference to Ration 14, which is intended for a clay farm growing strong meadow grass, it is suggested that a patch of a few acres be ploughed and always kept for mangolds. This root can be grown on the same land year after year quite successfully, one advantage of such a system being that the land is always clean and ready for the crop to be drilled early in the spring. In these rations the laxative element is supplied respectively by the mangolds, bran, treacle, and linseed. Whether the treacle or linseed is absolutely necessary will depend on the nature of the hay. If "herby," that is, containing rib-wort, yarrow, the smaller *Umbelliferæ*, &c., it may be sufficiently laxative of itself.

The complex mixture of No. 17, with the oil supplied in the cake and linseed, makes it a particularly palatable and digestible diet.

(V.) *A Town Dairy.*

For the town dairy "milk and beef" rations are required, such as the following:—

18.—21	lb.	Hay
28	,,	Wet Grains
2	,,	Bean Meal or Pea Meal
3	,,	Maize Meal

19.—14	lb.	Swedes
21	,,	Hay
3	,,	Bran
4	,,	Wheat or Barley Meal
3	,,	Decorticated Cotton Cake
½	,,	Linseed

20.—28	lb.	Hay
3	,,	Malt Coombs
1	,,	Decorticated Cotton Cake
4	,,	Cocoanut Cake
1½	,,	Treacle

In town cowsheds, roots, as a rule, are used only in small quantity, if at all, on account of the expense. To keep the cows' relish for their food keen, so that they may be fit for the butcher as soon as they become dry, it is the custom to chaff some portion of the hay, scald or steam it, and mix it with the meal or bran, and thus allow the cows two moist meals between the dry ones. Where roots are consumed this is not necessary, for healthy milking cows have good appetites and seem to enjoy thoroughly the chewing of long fodder when alternated with juicy roots.

In addition to the foods repeatedly included in the foregoing rations, malt coombs is a useful milk-producing food for mixing with chaff, with or without pulped roots. Maize germ meal and gluten meal are also useful foods for dairy cows, and may be used in quantities up to 4 or 5 lb. per head per day along with cake. Care should be exercised in purchasing, as materials sold under these names are found to vary greatly in nutritive properties. They are both products of maize and differ chiefly in the fact that the gluten meal is richer in albuminoids and poorer in oil and carbohydrates than the germ meal.

SUMMER FEEDING OF DAIRY COWS.

The feeding of cows in summer depends largely upon the character of the season and the quality of the pastures. Good pasture will supply all the needs of even the heaviest milkers up to about the middle of July in an average season. From this point onwards, however, the grass becomes increasingly deficient in albuminoids and more fibrous, so that it requires supplementing with an allowance of concentrated, easily digested food. This should be one of the more highly nitrogenous foods, such as decorticated cotton cake, soy bean cake, gluten meal, or linseed cake.

Commencing with 1 lb. a day in July, the cake should be increased gradually on ordinary pasture to about 3 lb. by the end of August. For cows that have calved in winter and early spring, and by this time are naturally going off their milking, this addition of cake is unnecessary, though it would benefit the land; neither is it necessary when cows are put on aftermath full of clover. On the other hand, the addition of some food like decorticated cotton cake, is necessary for all summer and autumn calving cows soon after they have calved. Some pastures produce very soft butter in June, and an addition of 1 lb. of decorticated cotton cake, though not otherwise required, would have the effect of considerably improving the consistency of the butter.

FATTENING RATIONS FOR ADULT CATTLE.*

For general principles see Vol. XVIII., p. 987.

The rations of fattening cattle are usually composed mainly of roots, oat or barley-straw, hay, and an allowance of cake or meals which is periodically increased as fattening progresses. On suitable rations the live-weight should increase at an average rate of about 2 lb. per day, this rate being, indeed, often exceeded by good animals. Assuming that the ration includes not less than about 14 lb. of coarse fodder, the rate of increase mentioned will require for a bullock weighing 1,000 lb. (say 9 cwt.) the daily supply of about 28 lb. dry matter with a starch-equivalent of 13 lb., including 1·6 lb. of digestible true albuminoids (or 1·9 lb. of digestible crude albuminoids). The amount of digestible oil included in the ration should be about ¾ lb., and the digestible carbohydrates will then be about 16 lb.

---

* The term "adult" may be taken to apply to cows and three-year old bullocks.

Rations are given below which correspond in composition and fattening value with this "typical ration."

The amounts are intended for a bullock of 9 cwt. live-weight, and require to be increased as the animal gains in weight, at the rate of about ·1 lb. digestible albuminoids and 1 lb. starch-equivalent for each hundredweight gain in live-weight. The allowance of cake and meal should be adjusted according to the progress made by the animal, as tested best by frequent weighings or otherwise by careful observation. If the animal is in very poor condition at the outset of the fattening period it should, for a few weeks, receive a more liberal allowance of albuminoids than is indicated above (see Vol. XVIII., p. 988).

1.—105 lb. Swedes
14 ,, Oat Straw
2 ,, Decorticated Cotton
2 ,, Linseed Cake

2.—98 lb. Swedes
14 ,, Oat Straw
or
84 lb. Swedes
19 lb. Oat Straw
3¾ ,, Undecorticated Cotton Cake
2½ ,, Linseed Cake or Soya Bean Cake

3.—56 lb. Swedes
21 ,, Oat Straw
or
70 lb. Swedes
16 lb. Oat Straw
4¼ ,, Crushed Oats
2¼ ,, Decorticated Cotton Cake
1 ,, Maize Meal

4.—42 lb. Swedes
7 ,, Hay
14 ,, Oat Straw
4¼ ,, Maize Meal, or 4¾ lb. Crushed Barley or Rice Meal
2¼ ,, Decorticated Cotton Cake.

5.—28 lb. Swedes
14 ,, Hay
7 ,, Oat Straw
4 ,, Crushed Grain
3 ,, Undec. Cotton Cake
1¾ ,, Locust Bean Meal

6.—28 lb. Swedes
14 ,, Hay
10 ,, Oat Straw
4 ,, Cocoanut Cake
2¼ ,, Crushed Barley or Rice Meal, or 2 lb. Maize Meal

7.—35 lb. Mangolds
7 ,, Hay
14 ,, Oat Straw
4½ ,, Wheat Meal
3½ ,, Bean Meal

8.—28 lb. Hay
4 ,, Maize Meal, or 4½ lb. Barley or Rice Meal
1¼ ,, Dried Grains, or 1 lb. Bean Meal or Pea Meal
¼ ,, Linseed.

Rations 1, 2, and 3 are adapted for farms mainly under the plough, the first two being specially applicable to Scotland, where swedes and oat-straw apparently possess higher feeding value than is the case further south. No. 4 is for a farm half tillage and half grass, Nos. 5 and 6 are for one having about one-third of its land arable, No. 7 is for a farm on strong land where only home-grown foods are used, and No. 8 is for a grass farm.

Cotton cakes, soy bean cake and rice meal are largely favoured as concentrated foods, and usually supply the necessary nutriment at a cheaper rate than linseed cake. For finishing off fat cattle, linseed cake, however, imparts a "bloom" and "touch" which in the opinion of many feeders cannot be attained with any other food. For this purpose the cake used should be specially rich in oil.

In barley-growing districts, barley straw would probably take the place of oat straw in these rations; the former not being so nutritious, as a rule, some allowance can be made by increasing slightly the quantity of meal used. In the rapid fattening of cattle for the fat market it is more necessary to resort to chaffing, scalding, and mixing of foods, than in feeding cows for milk; the craving for food is keener in the latter than in the former, and fattening cattle are found to eat straw that has been chaffed, mixed with pulped roots, and allowed to lie a day before being eaten, or chaff scalded and mixed with meal of some kind, and a sprinkle of treacle, more readily than straw in the long dry state. Also, where no roots are available, some hay-chaff scalded or steamed and mixed with the meal or other trough food, and given alternately with long hay, induces the cattle to eat with more relish. Cattle spices or condiments are often used for the same purpose, but should be given sparingly and when other means of stimulating the appetite have failed.

CO-OPERATIVE COW INSURANCE SOCIETIES IN 1910.

The following statistics relate to the 22 co-operative societies in England and Wales, dealing with the insurance of cows and calves only, which were registered under the Friendly Societies Acts on December 31st, 1910. Besides these there are a considerable number of unregistered societies of a similar character, generally known as "cow clubs," but statistics regarding them are not available.

A registered cattle insurance society must consist of at least seven persons, must have its rules passed by the Registrar, must have its accounts annually audited and send a copy of them to the Registrar, and must appoint one or more trustees in whom its property is vested. The rules are binding on the members, and sums payable to the society by members are recoverable in the County Court.

The 22 societies had, in 1910, 1,631 members, giving an average of 74 members per society; the smallest number of members was 12, and the largest 331. The societies insured altogether 4,588 cows and calves, or an average of 209 per society, the smallest number insured in any one society being 14 and the largest 1,329. The total sum realised as premiums and levies for the insurance fund was £929, which gives an average premium of 4*s.* 0½*d.* per animal. The total amount paid on claims was £983, an average per animal insured of 4*s.* 3*d.*, and the total expenditure charged to the Insurance Fund was £1,015. Besides the premiums, there were other items of income credited to that fund, such as £10 for entrance fees, £103 for interest, £64 from the sale of carcasses, and £14 from donations and subscriptions, and altogether the income of the Insurance Fund during the year was £1,132; and the gross amount at the credit of this fund for the 22 societies increased during the year from £4,678 to £4,795.

The Act requires that a separate account shall be kept of the expenses of management, and of all contributions on account thereof. Some of the societies have irregularly charged management expenses to the Insurance Fund. Sixteen societies, insuring 4,017 animals, returned their cost of management as £95, which gives an average of less than 6*d.* per animal. The charges include, besides cost of rent and printing, £46 for salaries, the smallest salary paid being 2*s.* 6*d.*, and the highest £11 10*s.* in a club insuring 1,329 animals. Other expenses paid by the societies are small sums, such as 1*s.* or 1*s.* 6*d.* paid to the stewards or committeemen for attendance at meetings or visits to sick animals. To meet these management expenses it is usual to make a special levy of from 2*d.* to 6*d.* per animal, any deficiency being met from the income of the Insurance Fund other than premium income, such as the receipts from the sale of carcasses. For the 16 clubs already mentioned, the income of the management fund for the year was £97, including contributions and levies from members, made specially for this fund, amounting to £75, and averaging 4*d.* per animal insured.

For the 22 societies taken together, the surplus of assets over liabilities (other than insurance liabilities) was at the end of the year £4,812, as compared with £4,795 shown as at the credit of the Insurance Fund. With the exception of small sums left in the hands of the treasurer and a small amount otherwise invested, this money is deposited in the Savings Bank at 2½ per cent. interest, and the income of the 22 societies from interest in the year was £103. As the insurance contract with the members terminates every year, this £4,812 represents a true surplus accumulated during past years owing to the expenditure being less than the income. It not only brings in a considerable sum in interest, but secures the members against the risk of having to make special levies on themselves in order to meet losses in excess of available funds. It amounts on the average to £1 1*s.* per animal insured, enough in itself to meet nearly five times the amount actually paid on claims during the year 1910. Every society has a reserve fund of this description, the smallest being £26 for 14 animals insured at Croston, and the largest £1,176 for 1,329 animals at Whixall. The Prees Club has a reserve of £1,050 against 585 animals insured.

Perhaps the most important question for an insurance society is the rate of mortality to be expected. Statistics on this point are available for 17 of the 22 societies. Of the 4,243 animals insured by them, 94 died during the year, an average mortality of 2·2 per cent. per annum. (During 1911 the average mortality for 4,231 animals was 2·6 per cent.) Four societies insuring 133 cows had no deaths at all. For the societies insuring over 100 animals each, the highest rates of mortality were, at Friskney, 3·8 per cent. for 104 animals; Hanmer, 2·9 for 1,178 animals; Wem, 2·7 for 256 animals; Prees, 2·6 for 585 animals; and Whixall, 1·8 per cent. for 1,329 animals. This includes losses from disease or accident of any kind. Eleven of these 17 societies insure cows only, a heifer being usually reckoned as a cow from the time she is bulled, at, say, from about 12 to 15 months old. Six of the societies insure calves also, the general rule being not to insure calves under six months old, though one society insures them from three months old. Few societies have any rule against insuring cows above a fixed age, but one declines to admit cows over ten years of age, or to pay a claim on a cow over fifteen. The average mortality of 3,548 cows for the two years 1910 and 1911 was 2·2 per cent. per annum; for 689 calves it was 3·7 per cent.

The next point of importance is the amount the society will be called on to pay on the death of an insured animal. In the case of cows, six clubs pay the full value at the time the cow fell ill, up to a maximum of £10, one has fixed the maximum at £9, another at £12, and another at £14. Three clubs pay only three-fourths of the value without limit; one pays four-fifths of the value, with a limit of £16. Most clubs have only one rate of premium for cows and one rule as to payment. Three clubs have three grades of premium and three corresponding grades of payment; for instance, one club pays the value up to £12, £10, or £8, according as the annual premium paid is 6*s*., 5*s*., or 4*s*. Where calves are insured, the amount payable on death is usually the value up to £5 or £3, or if the calf be under six or nine months old, a fixed sum of £2. The actual amount paid in 1910 on 49 cows was £504, an average of £10 6*s*. per cow; on 12 calves it was £51, an average of £4 5*s*. per calf; for the 94 cows and calves paid for in 13 societies taken together it was £822, an average of £8 15*s*. per animal. The full market value of 44 cows averaged £15.

According to that one year's experience, therefore, these

13 societies may expect on the average to have to pay, under their rules, £8 15*s.* on 2·2 per cent. of the animals insured. To meet this loss would require a net income from premiums of 3*s.* 10*d.* per insured animal. As already stated, the actual sum realised in all 22 societies on 4,588 insured animals was £929, an average of 4*s.* 0½*d.* per animal, and the actual sum paid in losses was £983, an average of 4*s.* 3*d.* per insured animal, so that the total of premiums paid very nearly equalled the amount paid in claims in that year. Premiums are usually payable quarterly, the commonest rate for cows being in the larger societies 4*s.* per annum, but two societies charge 5*s.* and 6*s.*, and one as much as 8*s.* per annum. For calves the usual premium is 3*s.* per annum.

All the societies have a rule to the effect that if at any time the funds available are not sufficient to meet the claims, the members shall be liable to a special levy per insured animal to make up the deficiency; in some societies the amount so leviable at any one time is limited to 1*s.* per animal insured. Societies which have accumulated a considerable surplus are fairly secure against the risks of ever having to make such a levy; and, as a matter of fact, in 1910 only two societies did exact from their members an additional premium of this character, the extra rate in each case being 2*s.* per cow insured.

In addition to the quarterly premiums, it is usual to charge an entrance fee for each animal insured, the commonest rates being 6*d.*, 1*s.*, or 1*s.* 6*d.* per cow, and 6*d.* or 9*d.* per calf, but one society charges 7*s.* 6*d.*, and another 15*s.*, per cow on entry.

The hides and carcasses of insured animals that die generally belong to the society. They fetched on the average about £1 per animal.

The members of these societies are mostly small holders and cottagers, as is indicated by the fact that the number of animals insured is only 2·8 per member. Some of them have rules designed to keep out other classes, as, for instance, that no cattle-dealer or butcher may be admitted, or that the society is to be limited to persons who keep on an average not more than six head of stock, and are assessed to the poor rate at not more than £25 per annum. Some societies limit the number of animals that may be insured by any individual member, for instance, to 5 cows and 2 calves. In some cases the rules confine membership to residents within a circumscribed area, such as one or two adjoining parishes, and in practice this is always the case.

The working of each society is carried on by two or three trustees, a committee of management, one or more stewards, a secretary and a treasurer, all of whom are elected by a majority of votes at the general meeting of the members. The committee, to which the chief power is delegated by the general meeting, varies in numbers from 4 to 12, but generally consists of 5, 6, or 7 members. In most societies they work without remuneration, but some societies allow a small sum, such as 1*s*. 6*d*., to be paid them for a special meeting. The steward's duties are very responsible, as it is for him to pass as sound and brand as accepted animals offered for insurance, to visit any animal that falls sick or meets with an accident, value it for the purpose of determining what the society shall pay if it dies, and see that the owner takes all reasonable steps towards its recovery. In cases of doubt he is expected to call in one or two ex-stewards or members of the committee to help him in his decision. He generally receives a small fee of from 2*d*. to 6*d*. from the owner of each animal he brands, and 1*s*. or 1*s*. 6*d*. for attendance on the quarterly club nights, or when an insured animal dies.

Most of the societies have an elaborate system of fines for the maintenance of discipline. A member is liable to fine if he fails to pay his dues punctually, if he is absent without reasonable excuse on club nights, if he declines to accept office when elected by the general meeting, or if he offers a cow to be marked which he knows to be unsound. A member of the committee, steward, or treasurer is liable to fine if he neglects his duty. Many societies maintain an old rule to the effect that no member shall curse or swear or behave rudely or indecently at any of the meetings, on pain of forfeiting 6*d*. to the box; and one society has a curious rule laying down that any member repining or accusing one member of having received more benefit from the box than another shall forfeit 20 shillings. The small sum realised in fines shows that the need for enforcing these rules seldom arises. One society has a salutary rule that any member neglecting his cattle, and not taking care of the same in a good farmer-like manner, shall be excluded; another decrees expulsion against any member who shall misconduct himself or herself, or attempt fraud; another expels any member who shall endeavour to raise dissension or disaffection in the society to dissolve the union thereof, if such attempt or design be clearly proved; and another holds deserving of expulsion a member who, having received the benefit of the club, shall afterwards beg or solicit from other persons money towards making up his loss.

Of these 22 cow insurance societies, 10 have been in existence for over fifty years; one, at Mawdesley, in Lancashire, was started more than a century ago, and still insures 53 cows at a premium of 6*s*. a year, pays £10 on each cow that dies from disease or accident, and has a reserve fund of £46, enough to pay four years' probable average losses. To judge from the experience of these societies, it is possible for a community of small holders and cottagers, in any part of the country which is not exceptionally unhealthy for cattle, to form a co-operative mutual insurance society, and insure each other from loss of their cows by disease or accident up to a value of £10 per cow, on payment of charges amounting in all to less than 5*s*. per cow per annum.

The large insurance companies which deal in live-stock insurance, generally charge on dairy cows a premium of 7½ per cent. on the value insured (one company has recently raised its rate from 7½ to 8¾ per cent.). At 7½ per cent. a man insuring his cow for a sum of £10 payable on its death by disease or accident would have to pay to one of these companies a premium of 15*s*. per annum (which would not cover death from fire or lightning), as compared with the 5*s*. or less charged by these village cow clubs. One reason for this great difference in cost of insurance is that, unlike the village club, the large company has to set aside something like 40 per cent. of its premium income to pay for commission, agency fees, veterinary expenses, clerical and expert staff, interest on capital, depreciation of buildings, and profit to shareholders. The main reason, however, as shown by the figures which several companies have been good enough to furnish, is that their experience is that on the average about 6 per cent. of the dairy cows insured with them die every

COW INSURANCE SOCIETIES IN ENGLAND

Serial Number.	County.	Village.	Year of Establishment.	Year of Registration.	Number of Members.	Number of Animals Insured.	Number of Animals that died.	Amount of Claims paid to Members on Losses.		Total Expenditure of Insurance Fund.	
								£	s.	£	s.
1	Lancaster	Mawdesley	1807	1817	33	53	—				
2	Lancaster	Croston	1843	1844	12	14	1	10	0	10	0
3	Northumberland	Matfen	1851	1851	25	37	1	10	0	11	5
4	Derby	Tideswell	1838	1852	22	29	—			5	19
5	Salop	Whixall	1842	1857	307	1329	24	183	0	183	0
6	Salop	Prees	1838	1857	186	585	15	159	10	159	10
7	Salop	Tilstock	1859	1859	60	124		40	0	43	15
8	Lincoln	Friskney	1853	1859	70	104	4	46	0	46	0
9	Flint	Hanmer	1862	1862	331	1178	33	266	10	266	10
10	Derby	Beeley	1863	1865	29	29		9	6	9	6
11	York	Hunmanby	1866	1866	49	75		44	3	47	1
12	Salop	Wem	1871	1871	69	256	7	61	3	69	18
13	Lincoln	Sutterton	1861	1871	30	50	1	14	8	19	6
14	York	Brompton	1873	1873	12	24		14	5	15	0
15	Lincoln	Sibsey	1874	1875	66	93		52	16	52	16
16	Salop	Hodnet	1877	1877	49	90	2	23	18	23	18
17	Lincoln	Middle Rasen	1883	1883	22	46	1	6	17	6	17
18	Lincoln	Normanton	1886	1886	15	29	—				
19	Salop	Ellesmere	1887	1887	119	219	3	22	0	24	0
20	York	Saddleworth	1889	1889	16	38	1	8	18	8	18
21	Northumberland	Belsay	1890	1890	25	22	—				
22	Chester	Burleydam	1909	1909	84	164	1	10	0	11	18
					1631	4588	94	982	14	1014	17

AND WALES REGISTERED AT END OF 1910.

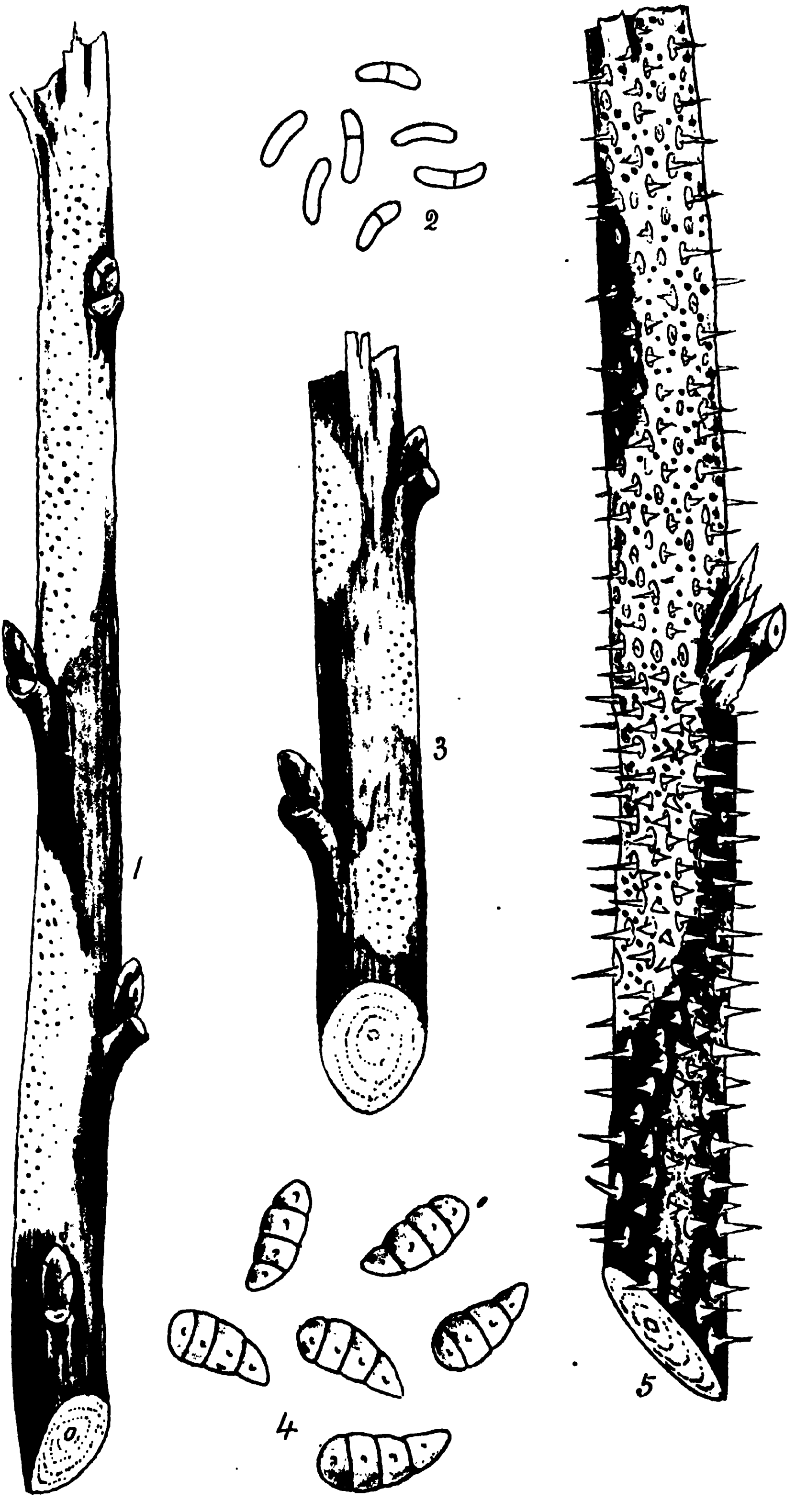
Income of Insurance Fund.					Amount of Insurance Fund.		Management Fund.				Surplus of Assets over Liabilities.	Serial Number.
							Expenditure.		Income.			
Premiums.	Levies.	Interest.	Sale of Carcases.	Total Income.	At beginning of year.	At end of Year.	Salaries.	Total Expenditure.	Contributions and Levies.	Total Income.		
£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	
19 10				19 10	26 4	45 14	2 2	4 12	4 12	4 12	45 14	1
7 0				14 10	21 16	26 6		9	9	9	26 6	2
10 16		1		12 6	13 8	14 9					14 9	3
7 0		7 15		14 18	228 13	237 12					237 12	4
254 2		25 12		283 10	1075 18	1176 8	11 10	21 8	10 16	21 15	1176 8	5
107 0		27 6	12 9	147 5	1062 2	1049 17	5 0	12 7	7 5	12 7	1049 17	6
30 19		4 9		35 8	215 0	206 13					206 13	7
31 4	10 8		2 0	45 2	74 3	73 5	1 15	3 0	2 16	2 16	71 11	8
199 14		11 17	41 9	253 10	489 5	476 5	9 0	29 17	30 0	30 0	477 15	9
2 18		2 7		7 15	95 6	93 15		10	10	10	93 15	10
24 12		5 17	1 10	34 4	223 10	210 13					210 13	11
53 11			3 15	57 6	186 1	173 9					173 9	12
19 5		3 0		22 5	124 9	127 8					127 8	13
2 13	2 9	13		8 1	60 15	53 16	10	10		10	53 16	14
28 9		4 1	3 0	35 10	180 19	163 13	5 10	5 13	4 2	5 13	163 13	15
20 16		3 17		24 13	165 19	166 14	1 0	1 5	2 10	2 10	169 5	16
2 2		13		3 3	30 7	26 13	2 0	3 0	3 9	3 9	28 6	17
6 5				6 10	28 18	35 8	3	13		15	42 5	18
43 9		2 12		48 3	218 18	243 1	4 0	5 4	2 4	4 4	244 10	19
9 1		1 8		11 18	55 9	58 9	8	1 16	1 19	1 19	59 5	20
5 0		1 17		7 0	100 14	107 14	5	18		18	108 6	21
31 2			5	40 3		28 5	3 3	3 10	4 8	4 8	31 13	22
916 8	12 17	103 5	64 8	1132 10	4677 14	4795 7	46 6	94 12	75 0	96 15	4812 9	

year, whereas the losses among cows insured in village clubs average only a little over 2 per cent. per annum. Among the causes which have been suggested for this great difference in experience are (1) that a distant and impersonal company is in greater danger than a village club, in which most of the members know each other and each other's cows, and all are interested in preventing any unfair risk to the society, of having foisted upon it doubtfully sound animals, while the sound animals remain uninsured, and of suffering from careless treatment of sick animals, or from excessive valuations of animals that may die; and (2) that the small holder's cow, being a precious possession always under the eye of its master and mistress, is more carefully watched, guarded, and tended than the cow in a large herd, which is apt to be looked upon as a mere machine for the production of milk. The truth seems to be that no company can be run so cheaply as a village cow-club, managed by the cow-owners themselves on neighbourly lines; and that there are few animals in the world so well protected from disease and accident as the British cottager's cow.

The Board will be obliged if any reader who knows of the existence of any cow insurance club not mentioned in this article will send information as to the name of the club, and the name and postal address of its secretary, to The Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W. Similar information regarding any such club that has ceased to exist will also be useful.

Diseases of Raspberry and Loganberry.

DURING recent years the canes of raspberries and loganberries have been observed to suffer to a considerable extent from the effects produced by microscopic, parasitic fungi, which are stated to be yearly extending their range of activity. The fungi implicated have been known for more than half a century as parasites on wild roses, brambles, and other rosaceous plants, and their rapid extension during recent years does not imply any increased power of parasitism, but is simply due to the increased number of suitable host-plants grown in juxtaposition.


1
2
3
4
5

Hendersonia rubi, Westendorp, is responsible for most of the injury caused to raspberries and loganberries. The canes or stems are the parts attacked, infection taking place during the summer, when the young growth is tender. The first indication of the presence of the parasite varies to some extent with the particular variety attacked, but as a rule lurid red or purplish patches of variable size appear on the stem. Such patches continue for some time to increase in size, and during the winter change to a pale grey or dingy white colour, due to the bark having been killed. At this stage the fruit of the fungus, in the form of minute black dots, is thickly scattered over the dead, white patches of bark. Microscopic examination shows that the minute black fruits contain myriads of coloured, four-celled spores. When mature these spores escape into the air, and those that happen to alight on young shoots germinate and enter the tissues, thus ensuring the continuance of the disease in the following season. When several diseased patches are present the canes are killed outright during the winter, whereas when only one or two diseased areas are present, the cane may survive and produce a certain amount of fruit. As the spores of the fungus, however, will be present in such cases, it is sound policy, even at the sacrifice of a certain amount of fruit, to remove and burn all canes, however slightly attacked, as it is only by such means that the disease can be eradicated. Infection mostly takes place at the period of the year when fruit is present, hence spraying cannot be resorted to unless the fruit is sacrificed, when Bordeaux mixture should be used. Even in these circumstances every diseased cane should be cut down the moment it is observed. The practice, common in many places, of allowing the dead canes to remain standing throughout the winter, is to be condemned.

A second fungus, *Ascochyta pallor*, Berk., sometimes occurs as a parasite on the stems of raspberries, roses, and brambles. It forms whitish dead patches, studded with black dot-like fruit. Treatment should be similar to that suggested against *Hendersonia rubi*.

Description of the Figures. Fig. 1.—Raspberry, showing pale, dead areas, caused by *Hendersonia rubi*. Nat. size.

Fig. 2.—Spores of *Ascochyta pallor*. Mag.

Fig. 3.—Raspberry, showing small, pale dead areas, caused by *Ascochyta pallor*. Nat. size.

Fig. 4.—Spores of *Hendersonia rubi*. Mag.

,, 5.—Loganberry, showing pale, dead area, caused by *Hendersonia rubi*.

Courses in Agricultural Colleges.

THE Board of Agriculture and Fisheries and the Board of Education have recently published the fifth report of the Rural Education Conference.* The subject of the report is the following reference received from the Board of Agriculture and Fisheries:—

"To consider and advise as to the considerations which should be borne in mind in the framing of courses occupying not less than two sessions at institutions devoted to the higher study of agriculture, and to report on the main characteristics which such courses should possess in order to render them suitable to those students who intend to take up practical farming or the management of landed estates."

The report points out that the reference is confined to what may be generally described as "long courses," such as are now given at agricultural colleges and university departments of agriculture, and does not include the shorter courses which only occupy one winter session or less. The reference further relates to two different classes of students:—(1) Those who intend to become practical farmers. (2) Those who intend to manage estates, either as landowners or land agents.

For the sake of clearness the consideration of the requirements of these two classes of students is kept as far as possible distinct from each other, although the courses of study for the two classes include many of the same subjects.

Courses for Intending Farmers.—At the present time all agricultural colleges and departments make some provision for this class of student, but the proportion of prospective farmers to the total number of students varies considerably at different institutions. The Conference are of opinion that it is desirable that all students attending long courses should have received a good secondary education, and have had at least one year's practical experience and residence on a farm. Sons of farmers able to attend such courses would usually have had sufficient experience of farming to enable them to take full advantage of a two-years' course at an agricultural college immediately after leaving a secondary school, and in their case the minimum age at which they might commence the course would be 16 years. In the case of town lads and others having no practical knowledge of farming it would be desirable that they should devote at least twelve consecutive months to farm work before commencing their course. In view of the difficulties experienced by students who are not farmers' sons in obtaining the necessary practical experience, it is desirable that the heads of colleges should prepare a list of farmers in their neighbourhood who are willing to offer farm pupils the practical training required, and it might be advisable for agricultural colleges with their own farms situated in their immediate neighbourhood to provide a twelve months' practical farm course, which such students could take before commencing the ordinary two years' course. The college farms, which have an area varying from 100 to 460 acres, would, in most cases, afford suitable facilities for such a course.

---

* Fifth Report of Rural Education Conference: Courses in Agricultural Colleges [Cd. 6151], 1912. Price, 3*d*.

The number of students attending the longer course at agricultural institutions appears to be increasing, and the Conference think that the time has come when the Governing Bodies of these institutions should require intending students to produce evidence of having received a good general education at a recognised secondary school or to pass a simple qualifying examination in such subjects as English, arithmetic, and mensuration. In future all prospective students should also be required to provide evidence of some acquaintance with practical agriculture.

The aim of courses for intending farmers should be the provision of a thorough grounding in the principles of practical agriculture, and in the sciences on which it rests, in so far as their laws in relation to agriculture have been ascertained and established. Even if progress were limited to securing that the practice of the best farmers of the country became universal, the economic benefits would be very great. The Conference are of opinion that this fact has not always been sufficiently recognised in the past, and they urge that teachers of agriculture should devote more attention to the study of the methods of skilled agriculturists.

The principal sciences in which instruction should be provided in the courses under consideration are Chemistry, Elementary Physics, with special reference to Mechanics, Botany, and Animal Physiology. It is obvious, however, that only an elementary knowledge of these sciences can be given in an agricultural course lasting two, or even three, years. Much difference of opinion exists as to whether "pure," as distinguished from "applied," science should be taught to agricultural students. The Conference are of opinion that wherever possible the elementary instruction in pure science which must precede more advanced instruction in applied science should be given by an agricultural scientist, and should be given an agricultural bias. Difference of opinion also exists among experts as to whether the curriculum for the first year should be devoted to science subjects or to agriculture or both. It is clear that much must depend on the previous knowledge of the students; students who have, before commencing their course, acquired a fair knowledge of practical farming might be expected to derive much advantage from a first year's course devoted wholly to science subjects, but students less well-equipped with practical knowledge would probably be unable to see what bearing the teaching had on agriculture, and their interest would not be secured. If, however, the recommendation referred to above with regard to the admission of students only after they had acquired adequate practical knowledge was generally adopted, the class of students attending agricultural institutions would become more uniform in this respect. In these circumstances it might be advisable to devote the first year mainly to the study of science, the teaching of which should be illustrated as far as possible by agricultural objects, and should include instruction in the properties of soils, the nutrition of plants, and the elements of manuring. The Conference also think that at least one day, or two half-days, a week should be allocated to such non-scientific subjects as surveying and practical instruction on the farm.

As regards the course taken as a whole it must always be remembered that the aim of the instruction in Agricultural Chemistry and Agricultural Botany should be, for the purposes of the class of pupil under consideration, to impart knowledge which will be of value to the student as a farmer, and not to train agricultural chemists and agricultural botanists. For instance, in agricultural chemistry, too much time should not be devoted to the technical methods of analysis used by professional agricultural chemists. The study of this subject should rather be limited to the acquisition of such a knowledge (both theoretical and practical) of the more elementary chemical facts upon which the life of animals and plants and the character of soils depend, as would enable the student to interpret the practical bearing of a detailed chemical analysis, *e.g.*, of feeding stuffs and manures.

In the past an attempt has been made to teach too many subjects, with the result that the instruction in certain important subjects, especially agriculture itself, has suffered. Geology, Entomology, and Mechanical Engineering are subjects the comprehensive study of which may, at any rate for the present, be left to pupils who will qualify as experts, to whom farmers would look when requiring special advice or assistance. Animal Physiology and Hygiene, on the other hand, are subjects to which too little attention has been devoted in view of the importance of the live stock industry in this country.

It is therefore suggested for the consideration of the Governing Bodies of agricultural institutions that the efforts of the staffs should be concentrated on the thorough teaching of Agriculture, including Manual Instruction and the use and repair of machinery, Chemistry, Botany, Animal Physiology, Elementary Surveying, and simple Farm Book-keeping, and that farmer-students should not be compelled to attend classes in the following subjects, which, while of much interest and value to farmers, cannot, with the subjects above-mentioned, be adequately taught in a two years' course :—Geology, Entomology, Engineering, Architectural Drawing, &c. Students should be given the opportunity of attending classes in one or more of these subjects, if they wish to do so. In view of the growing importance of rural economics and the material advantages to be gained from co-operative production, distribution, and supply, in connection with agriculture, it is highly desirable that these subjects should form part of a course of agricultural instruction for intending farmers.

The Report also refers to the extent to which this class of student should engage in practical farm work while at college, and the opinion is expressed that students should be encouraged to make themselves proficient in all the practical processes of farm work, and should be given a constant opportunity of observing the application on the college farm and on other farms in the neighbourhood, of the principles learnt in the class room; but it is not thought desirable that they should devote much of the time intended for college study to practical husbandry; the vacations and occasional afternoons during the terms would provide sufficient opportunity for this.

The minimum length of courses of the type under consideration should be two winter sessions with one summer term (five terms in all), or three winter sessions. For farmer-students who are able to attend a continuous course, the normal length, in the opinion of the Conference, should be two years (six terms); but students who have received a sufficiently good general education to enable them to pass a matriculation examination should be encouraged, if they can afford the time and money, to take a three years' course and work for a Degree in Agriculture. Other students should be encouraged to obtain a College Diploma or Certificate, which, in every case, should connote knowledge of practical farm work.

Courses for Students Intending to Manage Estates.—The minimum age at which this class of student should commence their course is 16 years, but preferably these students should not attend college until they are 17 or 18. With these students, as with those dealt with above, it is most desirable that they should have had at least one year's experience of practical farming before attending college in order to take full advantage of the course. The standard of general education should be higher in the case of these students, and the entrance examination should be equivalent to the Oxford or Cambridge Senior Local. A student who was able to produce a higher certificate or degree (including pure science) might be excused the first year's course.

The Report states that there is probably no institution which devotes itself entirely, or even mainly, to this class of student, and in very few institutions is the agricultural course at present given exactly suited to his requirements. The majority of students of this class should aim at obtaining an agricultural degree. For those, however, who do not propose to study for a degree, the most convenient arrangement will obviously be to require them for the first two years to follow a similar course to that prescribed for farmers (but exacting a somewhat higher standard), and to devote the third year to specialisation in appropriate subjects, while continuing their scientific training and knowledge of agriculture in the field as well as in the class room. For the class of student now under consideration, instruction should be provided in the following subjects, in addition to those mentioned above, as required by the student who intends to farm :—Forestry, Agricultural Valuations, Rating and Taxation, Agricultural Law (including landlord and tenant), Estate Book-keeping, Building Construction, and, in some cases, Advanced Surveying and Levelling. It would not be necessary, however, for instruction in all these subjects to be postponed until the third year, and it is recommended that an opportunity should be given to students who intend to farm as well as to those who intend to manage estates to attend classes in some of the above subjects during the first two years.

Degree and Post-Graduate Courses.—The courses for a degree in agriculture vary at different universities, but usually the first year is devoted to pure science and the second and third years to agriculture and agricultural science. The principal difference between courses for Degrees and the Diploma and Certificate courses, which we have previously been considering, is the increased knowledge of pure science which is required for a degree. It would not be practicable to insist on students who intend to study for a degree obtaining a thorough knowledge of practical agriculture before commencing their course, as in the case of those students who have not been brought up on a farm this would necessitate a considerable break between the time they leave the secondary school and proceed to the university. It is, therefore, necessary that these students should be given ample opportunity during their course of study of obtaining practical instruction on the university farm and other farms in the neighbourhood, and they should be encouraged, or even required, to spend their vacations on a farm.

While in Scotland the number of farmers' sons who obtain degrees is considerable, in England the number is small, and of these the majority probably do not intend to return to farming. It may be anticipated, however, that with the increased attention now being given to agricultural education and the improvement in education generally the number of practical farmers possessing agricultural degrees will steadily increase. With regard to the second class of student dealt with in this Report, it is recommended that every inducement should be given to future landowners and land agents to obtain an agricultural degree if they are able to devote three years to study at a university institution.

Scholarships.—The facilities for obtaining scholarships for courses such as are considered in the Report vary greatly in different counties. In a few counties no agricultural scholarships are offered by the County Council; in others, three or four, tenable for two or more years at an agricultural college or university agricultural department, are awarded annually; while in Yorkshire, and even more so in Lancashire, the opportunities for suitable students to obtain free instruction at such courses, together with a maintenance allowance, appear to be much greater. It is recommended that every County Council should award Senior Agricultural Scholarships, the examination for which should not be limited to literary, but should include some science subjects. Such scholarships might be awarded to students of not less than 16 years of age on leaving the secondary school and tenable at an agricultural college as soon as the holder can satisfy the principal as to his knowledge of practical farming.

There is also a great need for a larger number of "open" scholarships, such as those awarded by the Surveyors' Institution, and agricultural and similar societies as well as private individuals, are recommended to consider the advantage of offering such scholarships. Local education authorities might also consider the desirability of not limiting all their scholarships to the particular institution which they support.

In the appendix to the Report are published summaries of the evidence received from witnesses together with statements showing the number, parentage, occupations, or intended occupations of present and past students at thirteen institutions in England and Wales providing courses of the nature described in the Report.

Isle of Wight Bee Disease.

WITH the present issue of the JOURNAL the Board publish as a supplement* (Price 1s. post free), a very full report of investigations into the nature, history, and symptoms of the Isle of Wight Bee Disease, which have been carried out on behalf of the Board of Agriculture and Fisheries by G. S. Graham-Smith, M.D.; H. B. Fantham, D.Sc., B.A., F.Z.S.; Annie Porter, D.Sc., F.L.S.; G. W. Bullamore, and W. Malden, M.D., and the report in question comprises separate sections by these authorities on different aspects of the subject. Most of the work has been done in the Pathological Laboratory, Cambridge, under the general supervision of Dr. Graham-Smith.

It is shown that infection may be transmitted through the agency of infected foods or of living infected bees, among the former of which infected water and honey seem to be the most important. The introduction of the parasite into the hive is not necessarily followed by the appearance of the symptoms of the disease. It is probable that the stock sometimes remains healthy, and the infected bees are gradually eliminated; sometimes weeks or months elapse before the symptoms appear; occasionally the stock suffers severely for a time and then apparently recovers, though usually it succumbs in the end. Frequently the stock suffers from a mild form of the disease, but gradually becomes weaker and dies, and more rarely acute symptoms develop within a few days. The fact is emphasised that in the production of this disease, as in the production of most other diseases, various factors are concerned besides the mere introduction of the infecting agent. Unsuitable food, especially for wintering, lessens the natural resistance of the bee, and enables the parasite to develop more readily. Cold and damp weather and other unfavourable conditions act in the same way. On the other hand, suitable food and favourable climatic conditions increase the natural resistance of the bees, and, at least for a time, keep the disease in check.

---

* This supplement will be supplied free to subscribers to the *Journal* on written application.

In regard to preventive and remedial measures, drug treatment appears to have proved of little value, such treatment in the great majority of cases having produced no effect on the symptoms or rate of mortality. No undoubted example of a permanent cure appears to be recorded, and it is considered that in view of the nature of the causative agent it is exceedingly improbable that any of the usual drugs will be found to be of value. There is some evidence that the substitution of candy and syrup for natural stores for wintering is sometimes beneficial. The recommendations in relation to prevention of the disease include the provision of an easily accessible supply of fresh water, which should be changed daily; the collection and burning of bees dying with suspicious symptoms; digging and disinfection of the ground round the hives; disinfection of old hives; destruction of diseased stocks; removal of healthy hives to a fresh site if possible; re-stocking after an attack, when this is necessary, with bees from an infected area, since such bees, if they have survived an attack, may be to some extent immune, though some months should elapse between the death of the last stock and the importation of fresh bees; in non-infected districts driven bees or stocks should not be imported from infected areas; and the possible building up of apiaries from stocks which show well-marked resistance to the disease in infected apiaries or from stocks known to be partially immune.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

FIELD CROPS.

Cutivation of Sugar Beet (*Report on Experiments in the Cultivation of Sugar Beet in 1911, Board of Agriculture and Fisheries*).—These experiments were carried out on behalf of the Board by seven agricultural colleges, and the report has now been issued as a Parliamentary Paper. Some further particulars are given on p. 152.

The object of the experiments was to discover cultural methods suitable to the special conditions in this country, and with this in view the following points were tested at each centre:—(1) Sowing on the flat and sowing on the ridge; (2) different widths of rows and of singling; (3) manuring; (4) varieties; (5) quantity of seed.

---

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

At all the centres the preliminary preparation of the ground was carried out under exceptionally favourable conditions; the seed was sown in a good tilth, germination was regular, and the singling was completed by June without trouble. The drought in the following three months, however, practically ruined the crop in Devon and Essex, did considerable damage at Cirencester and Kingston, and only at the Harper-Adams College and at Wye were satisfactory crops obtained. In this respect, of course, the beet was in no way singular, as ordinary root crops failed completely over considerable areas in the south of England. The average gross yields—*i.e.*, the weights of roots freshly pulled but without the leaves—of all the varieties (except one); the estimated net factory weights—*i.e.*, the weights of roots washed and crowned; and the percentage of sugar in the roots at each of the stations, are shown in the following table:—

County.	Gross Yield per acre.	Estimated Net Factory Weight per acre.	Sugar in the washed and crowned roots.
	tons.	tons.	per cent.
Kent	26·6	18·8	17·0
Nottingham	14·4	12·6	16·5
Shropshire	15·0	13·4	17·7
Gloucester	9·4	8·2	19·8
Essex	8·7	7·5	15·8
Devon	5·0	4·5	15·8
Bedfordshire	13·8	12·9	18·5

As an indication of the weight of crop to be expected under normal conditions it is stated that the net factory weight of beet is likely to be about 40 per cent. of the yield of mangolds grown under similar conditions.

Cost of Cultivation.—At each centre a close estimate of the cost of growing and harvesting the crop was made. The figures varied from £9 3*s*. to £11 14*s*. per acre, and it is concluded that the average cost lies between £9 10*s*. and £11 per acre. The chief differences between the cost of growing mangolds and beet are, first in the hoeing and singling, and, secondly, in the lifting or pulling.

Growth of Linseed (*Univ. College of N. Wales, Bull. viii.*, 1911).—In continuation of trials conducted in the previous year, linseed was sown in quarter-acre plots at seventeen farms in North Wales in 1911. In most cases sowing took place in the second half of April, and the crop was harvested about the middle of August. At practically all the centres the crop suffered a good deal from the drought, and in many cases the plants did not reach a height of more than a foot. The yields reported may be classified as follows:—

At 3 centres over 10 cwt. of seed per acre was obtained.
At 3 ,, the yield was over 8 cwt., but under 10 cwt. per acre.
At 3 ,, ,, ,, ,, 6 cwt. ,, 8 cwt. ,,
At 6 ,, ,, ,, ,, 4 cwt. ,, 6 cwt. ,,
At 3 ,, ,, ,, was under 4 cwt. per acre.

It is added that the yield in all cases would doubtless have been considerably higher but for the difficulty experienced in thrashing, a good deal of the linseed being left behind in all cases.

At the College Farm two plots were sown. On one, plot A, linseed was sown alone, and on the other, B, along with a light seeding of oats, with the object of preventing the "laying" of the crop. There was, however, little difference between the two plots in this respect. The weights of linseed obtained were: A, 624 lb. per acre; B, 784 lb. per acre. The samples of seed varied a good deal; some of them were excellent.

Varieties of Maize for Forage Purposes (*Essex Educ. Com., Co. Laboratories, Chelmsford, Rept. on Field Expts.*, 1911).—The great need of a dairy district, particularly in a dry summer, is an adequate supply of succulent fodder. As maize is eminently adapted to meet this requirement, it was decided to test the relative cropping powers of some of the best-known Canadian and English varieties. The English varieties tested were White Tooth, Early Prolific, and Red Cob, the Canadian being Selected Leamington, Wood's Northern Dent, Eureka, White Pearl, and Superior Fodder. Owing to the lumpy condition of the soil when the seed was sown the weights of forage obtained were comparatively small, the heaviest crop obtained being 13 tons 8 cwt. per acre. Comparing the different varieties, White Tooth was superior to Red Cob, but the first three Canadian varieties, Selected Leamington, Wood's Northern Dent, and Eureka, were much superior to the English varieties. Not only was the weight per acre greater, but on their being chopped up they were found to be much more succulent. It is suggested that dairy farmers would be well advised to grow a certain acreage of maize every year as a safeguard against a dry season.

WEEDS AND PLANT PESTS.

Eradication of Wild Onion (*Jour. Roy. Agric. Soc.*, 1911; *Dr. J. A. Voelcker*).—Wild onion is known as a most objectionable weed, both on arable land and in pasture. On the former it may render corn unfit for milling, while in pasture or in hay it will readily communicate its odour to the milk of cows consuming it. It is seldom found on light land, but on heavy clay land it may spread to such an extent as to render the field quite useless. The difficulty of getting rid of it is due to the fact that it is readily propagated in three different ways:—(1) By seed; (2) by "bulbils" or "aerial bulbs" borne on the flower head, from which they fall off and give rise to new plants; (3) by "off-sets" from the bulb itself, these separating themselves in considerable numbers and each being capable of starting a fresh plant. A field of clay land adjoining the Woburn Experimental Farm was so badly infested with the weed that part of it never carried a successful crop of corn.

Experiments on the eradication of the pest were commenced at the Woburn Pot Culture Station in 1899, and have been continued ever since. The first attempts were directed to discover whether any "chemical" treatment would destroy the weed and prevent its spread. Then the use of lime and gas-lime was tried, and, finally, means for altering the mechanical and physical condition of the soil were tested. Simultaneously experiments were tried in the field, referred to above, with the forms of treatment which appeared from the pot trials to give prospects of success. None of the methods effectually destroyed the weed, and though the growth might be checked it was found that the hard off-sets from the bulbs were able to resist the action of even such materials as sulphuric acid, carbolic acid, &c. In 1902 a member of the Society offered the use of part of a field on his farm where wild onion was very prevalent. Here it was possible to lay out a comprehensive series of plots to test various systems of treatment. Of all the methods tried the only ones which seemed to promise any real success were the application of road-drift and the lightening of the land by an underbed of ashes. The latter would, of course, be impracticable on a large scale, but its success pointed to the conclusion that success might be achieved if means could be found of rendering the soil lighter and less retentive of water. With this in view, a fresh series of plots was laid out in 1904, and this included a plot sown with lucerne and another with a grass seeds mixture containing a considerable proportion of strong-growing and deep-rooted plants, being, in fact, one of the mixtures recommended by Mr. R. H Elliot, Clifton Park, Kelso. The object in including both these plots was to see whether, by introducing deep-rooted plants, the soil could be opened up so as to facilitate drainage.

The seeds were sown in spring, 1905, and in the case of the two plots, particularly of that sown with the grass mixture, the results have been most successful. Each year from 1905 to 1910 a good crop of hay was obtained, and even in 1906 not a single seed head of wild onion could be seen. At the end of 1910 the lucerne had begun to fail, and the grass was becoming poor also, so it was decided to plough both plots up. An examination of the ploughed ground, which was left fallow in 1911, showed that while the greater part of the field was thick with onions, on the plot where lucerne had been only a very few stems were found, and on the "Elliot's" plot not a single onion stem could be seen over the whole plot, and to find an onion on it anywhere was a matter of minute search; bulbs found were generally in a state of decay. So far as the examination showed, the plot had been freed almost entirely from the weed.

Destruction of Runch by Sulphuric Acid (*Jour. d'Agric. Pratique, March 30th,* 1911, *and March 21st,* 1912).—Experiments in the Department of Lot-et-Garonne with solutions of sulphuric acid for destroying runch and similar weeds in autumn-sown cereals are reported in this publication to have been very successful, and the acid is said to have been much more efficacious than sulphate of iron or sulphate of copper.

An 8 per cent. solution applied at the rate of about 100 gallons per acre was found efficacious against runch. The most serious disadvantage of the method is the fact that special spraying machines are necessary, as the acid attacks copper.

Wet Rot of Potatoes (*Arb. Kais. Biol. Anstalt für Land- u. Forstwirtschaft, Band* 8, *Heft* 4).—An account is given in this publication of investigations on the bacteria causing wet rot in potatoes, and the following measures for the prevention of the disease are advocated:—

In storing potatoes:—

(1) Avoidance of high temperatures; the extensive development of the bacteria at a temperature below 46° F. is impossible. (2) Avoidance of moisture; the wounds of an infected potato will heal if kept thoroughly dry. (3) Good ventilation; if ventilation is defective the appearance of anærobic fermentative bacteria in large numbers is to be feared. (4) Removal of all diseased potatoes from storage.

In the field:—

(1) Avoidance of cuts in the potatoes used as seed. (2) Avoidance of too heavy dressings of guano, nitrate of soda, salt, and lime, as these favour the growth of the bacteria. Superphosphate and sulphate of ammonia are recommended. (3) Improvement of soils which are too heavy or too strongly caked, as the disease appears more strongly on such soils. (4) Avoidance of infection of soil by removal of diseased plants. (5) Planting of resistant varieties in infected fields.

Prevention of Damage by Turnip Fly (*Essex Educ. Com., Co. Laboratories, Chelmsford, Rept. on Field Expts.*, 1911). In 1911 conditions were ideal for the Turnip Fly, and an experiment was conducted at the Central Experiment Station to test some of the remedies advocated. The following manures and insecticides were put to a full test:— Sulphur, paraffin emulsion, soot, lime, spent tan, and calcium nitrate.

Sulphur, soot, and spent tan were applied separately along the turnip drills, when the leaves were damp, but were of no value, the beetles returning to the plants a few minutes after application.

Lime had a slightly beneficial effect. It was observed that after its application the plants were not infested to the same extent as before.

Paraffin emulsion when sprayed along the rows of young plants drove the beetles off and prevented their return for a day. Owing, however, to the extreme heat, the paraffin soon volatilised, and the emulsion lost its efficacy.

The application of calcium nitrate at the rate of 1 cwt. per acre was attended with considerable success; the growth of the plants was stimulated, and they were enabled to reach the rough-leaf stage early. The rows so top-dressed took the lead and held it throughout the period of growth, their superiority being noticeable some distance away.

Protection of Newly-sown Corn from Birds (*Nantwich and Acton Grammar School Report*, 1911).—In the gardens attached to the school birds are exceedingly troublesome, and an experiment was carried out to see if seed could not be rendered distasteful. Different lots of seed rye were treated as follows:—(*a*) Rubbed in red lead; (*b*) soaked in a 10 per cent. solution of copper sulphate; (*c*) soaked in paraffin; a fourth lot being left untreated. Part of the ground sown with these lots of seed was also protected by black thread. The corn on the part thus protected came up well, showing that the germinating power of the seed had not been affected by the treatment. From the rest only a few plants were obtained, the treatment apparently having had little or no protective effect. In a previous test, soaking oats in bitter aloes was equally ineffective.

DAIRYING.

Tests of Milking Machines (*La Vie Agricole et Rurale, January 6th, 1912, abstracted in Bull. Bur. Agric. Int. and Plant Diseases, February, 1912*).—Tests of five milking machines were carried out for the Agricultural Society of Meaux, viz.: two suction machines the Wallace and the Max—and three pressure machines—the Alfa Dalen, the Loquist, and the Galakton machines.

It was found that the suction machines did not completely empty the udder, though in the case of cows with small teats the amount left was small. In the case of cows with large teats the amount left in the udder was much more appreciable, possibly owing to the fact that the machines were made for Dutch or Danish cows, which usually have small teats. On the whole, the amount of milk left by the two suction machines during a month's experiments varied from 5·4 per cent. to 8·5 per cent. The pressure machines were much more efficacious.

The total amount of milk obtained by mechanical milking finished by hand was found to be equal to that given by simple hand milking, and the apparatus did not in any way affect the quality of the milk. Special precautions as to cleansing the machines were found necessary.

The time required for milking a cow yielding 3 gallons was found to be 8 minutes for a suction machine, and 12 minutes for a pressure machine, against 6 minutes by hand milking. One operator and a cowman could, however, work five suction machines at a time, thus accomplishing as much as three men milking by hand. It is estimated, however, that the saving of the cost of the labour of the one man would be more than balanced by the annual cost of upkeep of the machines, even if the initial outlay is not taken into account.

Results of Bacteriological Analyses of Condensed Milks (*Rept. by Dr. F. J. H. Coutts to the Local Government Board on an Inquiry as to Condensed Milks, 1911*).—Until recent years condensed milk has been looked upon as a particularly safe food from a bacteriological point of view. It seems to have been assumed that the high temperature to which the milk is subjected in the course of preparation gives a practically sterile product. Recent investigations have, however, shown that living micro-organisms are always present in ordinary sweetened condensed milks, and sometimes in considerable numbers. The occasional occurrence of "blown" tins is evidence of this. In the particular investigations reported on, fifteen different brands were examined, with the following results.

In the case of four samples of unsweetened milks, no organisms were found that were likely to have existed in the milk before condensation. It therefore seems probable that in the process of condensing unsweetened milk sterility is secured, and that the organisms present were introduced from the air subsequent to condensation, but before the tins had been sealed.

In the sweetened milks (both "full cream" and "machine skimmed"), bacteria, which were almost certainly derived from the original milk, were found. It is evident therefore that in the process of condensing sweetened milk sterility is not secured, and that some of the organisms present in the original milk do as a rule survive the process of condensation.

MISCELLANEOUS.

The Influence of Electricity on the Respiration of Germinating Seeds (*Abstracts of Papers read at Meeting of Brit. Assoc.*, 1911; *Messrs. J. H. Priestley and R. C. Knight*).—In many experiments upon the electrification of plants, an acceleration in growth and an earlier attainment of maturity have been noticed. This appears to indicate an acceleration of the normal vital processes of the plant, and as the rate of respiration of germinating seeds appeared likely to be a reliable index of such acceleration, if it existed, a long series of experiments was carried out to test the influence of electrification on germinating seeds. Electrification was carried out in three different ways, with results varying according to the method adopted.

When seeds were subjected to an ordinary direct current varying from 0·75 to 9·0 milliampères a considerable decrease in respiration was observed. With a rapidly alternating current, the effect varied with the current. A current of 50 microampères produced an increase in respiration of about 30 per cent., one of 150 microampères had no effect, and one of 500 to 600 microampères resulted in a 20 per cent. decrease.

When the seeds were subjected to an overhead discharge the results were irregular at first. This was found to be due to the evolution of ozone, which in the confined atmosphere exerted a depressing effect on the output of carbon dioxide. When this effect was eliminated there was a considerable increase in respiration as a result of electrification. The amount of increase varied with different sets of seeds, the largest obtained being 110 per cent. with peas.

The Influence of Weather on Bees (*Nature, March 21st*, 1912; *Mr. Herbert Mace*).—It is universally recognised that weather plays a very important part in the life and work of bees, but very little has been done to determine exactly the effects which different types of weather have upon them. The writer commenced therefore in 1911 to record daily observations of the weather and of the increase in weights of two hives, one of which contained a strong colony, the other a weak one. The apiary is situated about 300 ft. above sea-level in a good position, and there is a good succession of honey-producing plants from April to the white clover season, from which the main crop is usually gathered. In 1911 the white clover, however, lasted a comparatively short time owing to the drought. The conclusions drawn from the observations recorded may be summarised as follows:—

(1) Sunshine is of the utmost importance. There were fourteen days when the sky was completely overcast, and the average for those days showed a net daily loss of 0·053 lb. in the strong colony and 0·146 lb. in the weak one, whereas average gains when at least a part of the day was quite clear were about 1¼ lb. and 1 lb. respectively. There were twenty-four days when the sky was intermittently overcast, and in both hives the average increase on these days was below that for the whole period.

(2) High winds cause great loss of bees, and it is suggested that,

when such prevail, bees should be confined to the hives unless there are sources for honey-gathering in the immediate vicinity. If they have to fly high or to travel far, the gain of honey, if any, will be more than counterbalanced by the great loss of bees.

(3) Low temperature causes extremely poor results. Classifying the maximum temperatures recorded into three groups—those below 65°, those above 66° and below 75°, and those above 75°—the average results for the two hives under the three classes of temperature were a gain of 0·108 lb. and a loss of 0·068 lb. respectively; gains of 0·723 lb. and 0·213 lb. respectively; and gains of 1·182 lb. and 0·743 lb. respectively.

The influence of low temperature is felt in two ways—firstly, particularly in a weak colony, the bulk of the bees have to remain in the hive to keep up the temperature so as to avoid chilling the brood, and, secondly, the flowers are affected and the amount of nectar secreted is diminished.

No conclusive evidence was obtained in support of the theory that warm nights induce a flow of nectar, and the statement often made by bee-keepers, that there is rarely a flow of honey during the prevalence of an east wind, was not supported by the results obtained in 1911.

In some ways the most striking results obtained were the differences recorded between the two hives. The two queens were sisters, that in the strong hive being in her third season, and that in the weak one being in her second. It is generally agreed that a queen in her second year is at her best, and this being so, the second colony ought to have given the better results. The natural advantage was, however, in this case more than neutralised by the shortage of stores possessed by the colony at the commencement of the season. The deficiency might have been artificially made up, but for the purposes of the experiment this was not done, with the result that the effects were most marked all through the season. The strong hive altogether made a total gain of 76 lb. in the season, while the weaker one only gave 36½ lb. increase, the average daily increases thus being 0·791 lb. and 0·447 lb. respectively. It is emphasised that it is of the utmost importance that colonies should meet the winter with abundance of stores, so that the earliest spell of fine weather in spring may be utilised by the queen for breeding. Otherwise the first honey flow from fruit and forest trees cannot be fully utilised.

Vitality of Farm Seeds (*Journal of the Roy. Agric. Soc.*, 1911; *Mr. W. Carruthers*).—An extensive series of experiments was commenced in 1896 with a view to testing:—(1) how long under ordinary conditions of storage the vitality of certain seeds is maintained; (2) to determine the annual loss of vitality; (3) to ascertain the real value of seeds held over for one or two years; and (4) to investigate the rapidity of germination of the seeds experimented with. Samples of forty-three kinds of seed, including those of six cereals, seventeen grasses, twelve clovers, six turnips and allied plants, carrot and yarrow, from the harvest of 1895 were obtained. The samples have been stored in paper bags in the close-fitting drawers of a cabinet, and have been regularly tested each year. Full details of the results are given; the following is a brief summary:—

Cereals.—In the case of barley and wheat the germination was but little affected during the first five years, but thereafter a rapid loss of vitality occurred, and proceeded at an increasing rate till in the tenth year no live seeds remained. Oats were quite different; not until the ninth year was there any serious loss of vitality, but by the end of the fourteenth year no living seeds of white oats remained. Some of the black oats lived for two years longer. The greater vitality of oats as compared with wheat or barley is stated to be due to the protection afforded to the embryo of the oat by the fact that in its case the glumes which, in wheat and barley, fall off as chaff, remain attached to the seed.

Grasses.—The death of all these seeds occurred between the eighth and the thirteenth year, but there was a good deal of variation as to the manner in which the loss of vitality occurred. Some, such as timothy and tall oat grass suffered little for the first four years, though after that the loss was rapid; in others, such as hard fescue and sheep's fescue, the loss was heavy and rapid until a germination of below 10 per cent. had been reached, but after that it remained stationary for a year or two. Still others, such as Italian ryegrass and meadow fescue, showed a fairly steady decline from first to last.

Clovers.—Of the three true clovers, all the seeds of red were dead in eleven years; alsike and white showed a small percentage of germinating seeds in the eleventh test. Sainfoin was shorter lived and lucerne survived two years longer. On the whole the clovers lose little during the first three or four years, then there is a rapid loss for another four years, and finally the last 10 per cent. of germinating power is only slowly lost during the space of another three or four years.

Turnips and Allied Plants.—The special feature of this group was the remarkable drop in the germination during the tenth year. Practically all finally lost their vitality in the thirteenth year.

Rapidity of Germination.—In these experiments records were also kept to ascertain the rapidity of germination, a character in which seeds differ greatly. In the first year eleven kinds of seeds completed their germination within a week, viz., barley, white oats, meadow fescue, timothy, white clover, sainfoin, swedes (2), turnips (2), and rape. On the whole, as the seeds became older the time required for germination increased, though it was noticeable that in the case of the five seeds—smooth-stalked meadow grass, wood meadow grass, cocksfoot, sweet vernal, and sheep's fescue—which were specially slow in germinating, every one showed more rapid germination in the second year than in the first, and in three of them it was more rapid still in the third year.

Names and Routes of the King's Premium Stallions.

Particulars of the Routes of the Stallions to which King's Premiums and Super-Premiums were awarded at the Show held at the Royal Agricultural Hall, Islington, London, N., on March 12th, 13th, and 14th, 1912, together with the names and addresses of the owners of the Stallions, and of the members of the Stallion Committees which have been appointed to supervise the service arrangements, are given below. The Routes are subject to some alteration by arrangement between the owners and the Stallion Committees.

District Class.	Stallion and Owner.	Free Nominations.		Route.	Stallion Committee.
		Counties to which allotted.	Number allotted.		
I.	**Money Spinner.** Dr. A. O. Haslewood, Fairfield Stud, Buxton.	Aberdeen ...	20	Headquarters:—Inverurie ... ... Travels Echt, Lumphanan, Alford, Huntly, Insch, Rothienorman, Turriff, Strichen, Peterhead, and Ellon.	Mr. G. Anderson, West Fingask, Old Meldrum, Aberdeenshire. Mr. A. T. Gordon, Freefield, Insch, Aberdeenshire. Col. A. J. King, Tertowie House, Kinellar, Aberdeen. Mr. J. E. McQueen, 34 Bridge St., Aberdeen.
	Bedlington. Dr. A. O. Haslewood, Fairfield Stud, Buxton.	Elgin ... ... Banff	10 10	Headquarters:—Elgin... ... ... Travels Forres, Grantown, Aberlour, Dufftown, Keith, Marnoch, Portsoy, Deskford, Fochabers, and Garmouth.	Mr. W. Rose Black, Bank Buildings, Elgin. Mr. G. Donald, Ladyhill, Keith. Mr. G. A. Ferguson, Surradale, Elgin. Mr. T. P. Horsfall, Braco, Keith.
II.	**Ormeton.** Dr. A. O. Haslewood, Fairfield Stud, Buxton.	Fife	20	Headquarters:—Montrave ... ... Travels St. Monance, Cupar, Auchtermuchty, Milnathort, Kinross, Auchtertool, Kirkcaldy, Wemyss Castle, Thornton, and Markinch.	Mr. W. Blackie, Groveside, Largo, Fife. Mr. J. Cairns, Abercrombie, St. Monance, Fife. Mr. T. Webster, Nisbetfield, Collessie, Ladybank.
	General Stössel. Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.	Forfar ... ... Perth	15 5	Travels Forfarshire, and East Perthshire.	Mr. J. Carmichael, Arthurstone, Meigle, Perthshire. Mr. H. K. Ogilvy, Auchterhouse, Dundee. Mr. G. Ralston, Glamis, Forfar. Mr. W. A. Scott, Newton of Arbirlot, Arbroath.
	Elector. Mr. A. McMahon, Colt Stud Farm, Abbeyleix.	Berwick ...	20	Headquarters:—Kelso... ... ... Travels Coldstream, Swinton, Paxton, Ayton, Reston, Duns, Greenlaw, Gordon, and St. Boswells.	Mr. J. Fulton, Hatchednize, Coldstream. Mr. G. Hogarth, Edrington, Berwick. Mr. A. Lyal, Green Knowe, Gordon, Berwickshire.

District Class.	Stallion and Owner.	Free Nominations.		Route.	Stallion Committee.
		Counties to which allotted.	Number allotted.		
III.	**Likely Bird.** Mr. F. Young, 28 Duke Street, Chelmsford.	Wigtown ...	20	Travels Wigtownshire	Mr. P. J. Adair, North Strand Street, Stranraer. Mr. A. Crawford, Broughton Mains, Sorbie, Wigtownshire. Mr. A. B. Matthews, Newton Stewart.
IV.	**Drummer Kelly.** Messrs. T. & W. Walton, The Stud Farm, Guisborough, Yorks.	Durham ...	15	Headquarters:—Guisborough ... Travels Darlington, Yarm, Stockton-on-Tees, Wolviston, and Sedgefield.	Mr. W. N. Dobbin, M.R.C.V.S., Skinnergate, Darlington. Mr. C. E. Faber, Stockton-on-Tees. Mr. R. G. Heslop, Selaby Farm, Gainford, Darlington.
	Jovial. The Lord Middleton, Birdsall, Malton.	York (North Riding).	15	Headquarters:—Birdsall ... ... Travels Malton, Pickering, Normanby, Salton, Ness, Horningham, and Sheriff Hutton.	Mr. E. Parsons, Birdsall, Malton. Mr. F. Reynard, Sunderlandwick, Driffield. The Hon. T. Willoughby, Hildenley Home Farm, Malton.
	Fealsham. Mr. J. Brown, The Common, Kirby Moorside, Yorks.	York (North Riding)	15	Headquarters:—Kirby Moorside Travels Gilling, Easingwold, Thirsk, Northallerton, Hawnby, and Helmsley.	Mr. W. Coates, Helperby Hall, York. Mr. F. Samuelson, Breckenbrough Hall, Thirsk. Mr. P. C. Sherbrooke, Kirby Moorside, Yorks.
	Hon. Jummy. Mr. W. S. Ridehalgh, Kent's Ford, Grange-over-Sands, Lancs.	Lancashire ...	15	Headquarters: — Grange-over-Sands ... ... Travels Cark, Ulverston, Dalton, Barrow, Carnforth, and Lancaster.	Mr. J. Blundell, Lower Burrow, Scotforth, Lancaster. Mr. G. Dickinson, Cark Mills, Cark-in-Cartmel, Lancashire. Mr. E. Whinnerah, Warton, Carnforth.

V.	**Royal Bow.** Messrs. Flannery Bros., Churchtown, Buttevant, co. Cork.	Lancashire ...	15	Headquarters:—Rochdale ... ... Travels Bolton, Chorley, Blackburn, Clitheroe, Haslingden, Accrington, and Burnley.	Mr. J. Kerr Calderwood, M.R.C.V.S., Ingledale, Clitheroe. Mr. T. Ellis, Earl of Derby's Estate Office, Bury. Mr. J. T. Pilling, The Thrums, Rochdale.
	Tydides. Dr. A. O. Haslewood, Fairfield Stud, Buxton.	Cumberland ...	15	Headquarters:—Wigton ... ... Travels Aspatria, Penrith, Kirkoswald, Brampton, Carlisle, and Cockermouth.	Major S. Ferguson, 37 Lowther Street, Carlisle. Mr. R. Edwin James, Manor House, Oughterside, Carlisle. Mr. W. R. Mounsey, 20 King St., Penrith.
	Crathorne. Mr. A. McMahon, Colt Stud Farm, Abbeyleix.	Lancashire ...	15	Headquarters:—Warrington .. Travels Leigh, Newton-le-Willows, Earlestown, Rainford, Ormskirk, Wigan, and Billinge.	Mr. J. Hamilton, Garswood Old Hall, Garswood, Wigan. Mr. N. Richardson, Rainford House, Rainford, St. Helens. Mr. W. Woods, F.R.C.V.S., 28 Standishgate, Wigan.
VI.	***†King's Courtship.** Messrs. T. L. Wickham-Boynton, and H. A. Cholmondeley, Burton Agnes, Driffield.	York (East Riding).	15	Headquarters:—Burton Agnes ... Travels Bridlington, Driffield, and Hedon.	Mr. J. S. Chubb, Sledmere, York. Mr. B. C. Pennington, Estate Office, Burton Agnes, Driffield. Mr. F. Reynard, Sunderlandwick, Driffield.
	***‡Wales.** The Lord Middleton, Birdsall, Malton.	York (East Riding).	15	Headquarters:—Birdsall. Travels Sledmere, Weaverthorpe, Dale towns, Sherburn, and Ganton.	Mr. E. Parsons, Birdsall, Malton. Mr. F. Reynard, Sunderlandwick, Driffield. The Hon. T. Willoughby, Hildenley Home Farm, Malton.
	***Birk Gill.** Mr. E. H. Barlow, Sigsworth, Pateley Bridge, Yorks.	York (West Riding).	15	Headquarters:—Pateley Bridge ... Travels Ripley, Harrogate, Knaresborough, Wetherby, Boroughbridge, and Ripon.	Mr. B. North, 31 Market Place, Ripon. Mr. T. Robinson, The Laurels, Wetherby. The Rev. C. S. Slingsby, Scriven Park, Knaresborough.

* Indicates the award of a Super Premium. † Indicates the award of the King's Champion Challenge Cup.

District Class.	Stallion and Owner.	Free Nominations. – Counties to which allotted.	Free Nominations. – Number allotted.	Route.	Stallion Committee.
VI. *cont.*	**Selby Royal.** Mr. J. H. Richardson, Westfield, Acomb, York.	York (West Riding).	15	Headquarters:—Acomb ... ... Travels Tadcaster, Pontefract, Barnsley, Badsworth, and Selby.	Mr. B. Day, The Rookery, Chapel Allerton, Leeds. Dr. Sullivan, South Kirkby, Wakefield. Mr. C. H. Taylor, Hampole Priory, Doncaster.
VII.	***Akbar.** The Southwold Hunt Sire Association, Claythorpe Manor, Alford.	Lincoln (parts of Lindsey).	15	Headquarters: Alford ... ... Travels Louth, Brocklesbury, and Horncastle.	Mr. H. D. Addey, Claythorpe Manor, Alford. Mr. E. Crowder, Thornton, Horncastle. Mr. W. B. Swallow, The Lawn, Wootton, Ulceby, Lincs.
	Garb Or. Messrs. E. S. Tomlinson and C. J. C. Hill, North Rauceby, Grantham.	Lincoln (parts of Lindsey).	5	Headquarters:—Rauceby ... ... Travels Sleaford, Lincoln, Glentworth, Gainsborough, Retford, Marnham, Newark, and Grantham.	Mr. F. A. Holmes, M.R.C.V.S., Hemswell, Lincoln. Mr. C. W. Lister-Kaye, Estate Office, Osberton, Worksop. Mr. W. Newton, Barrowby Old Hall, Grantham. Mr. O. Quibell, Newark.
		Lincoln (parts of Kesteven).	5		
		Nottingham ...	5		
VIII.	**Ipswich.** Dr. A. O. Haslewood, Fairfield Stud, Buxton.	Derby	15	Headquarters:—Buxton ... ... Travels Bakewell, Derby and Ashbourne.	Mr. S. Burton, Canal Office, Derby. Messrs. Hampson Bros., 3, The Quadrant, Buxton. Mr. A. P. Payne-Gallwey, Castle Hill, Bakewell.
	King Grouse. Dr. A. O. Haslewood, Fairfield Stud. Buxton.	Stafford.. ...	15	Headquarters:—Trentham ... ... Travels Newcastle, Longton, Stone, Sandon, Rugeley, Armitage, Longdon, Penkridge, Stafford, Eccleshall, and Whitmore.	Mr. W. Blocklay, Moor Hall, Madeley, Newcastle, Staffs. Mr. J. W. Coe, F.R.C.V.S., Stoke-on-Trent. Mr. J. Keen, Hill Top, Longdon, Rugeley. Mr. W. J. Nuttall, Parkhill, Chartley, Stafford. Mr. E. Woodcock, M.R.C.V.S., Eccleshall, Stafford.

IX.	**Bacton Lad.** Mr. F. W. Barling, M.R.C.V.S., Bartestree Court, Hereford.	Hereford ...	Headquarters:—Bartestree ... Travels Ledbury, Hereford, Ross, Leominster, and Bromyard.	Mr. J. Bird, Livers Ocle, Hereford. Capt. E. L. Heygate, Buckland, Leominster. Mr. E. H. Landon, Bullingham, Hereford.
	Christmas Greeting. Mr. T. J. Hillman, Stud Farm, Stock Wood, Redditch.	Salop	Headquarters:—Whitchurch ... Travels Oswestry, Wem, Shrewsbury, Kinnersley, and Market Drayton.	Mr. H. Mason, Kinnersley Manor, Wellington, Salop. Mr. T. M. Parker, M.R.C.V.S., Whitchurch. Mr. T. Podmore, Oakley Park, Market Drayton.
	Avico. Mr. R. H. Farmer, Chapel Brampton, Northampton.	Chester	Headquarters:—Bunbury ... ... Travels Nantwich, Sandbach, Middlewich, Tarporley, Farndon, Chester, and Tarvin.	Mr. J. J. Jersey de Knoop, Calveley Hall, Tarporley. Mr. J. W. Macfie, Rowton Hall, Chester. Mr. B. D. Poole, Marbury Hall, Whitchurch.
X.	**Pedlar Brand.** Mr. D. Davies, M.P., Plas Dinam, Llandinam, Mont.	Denbigh ... Flint	Headquarters:—Wrexham ... ... Travels Ruthin, Denbigh, Caerwys, and Mold.	Mr. T. O. Bury, Regent Street, Wrexham. Mr. A. E. Evans, Bronwylfa, Wrexham. Mr. G. Fitzhugh, Plas Power, Wrexham. Major T. M. Keene, Mold. Mr. W. R. K. Mainwaring, Hartsheath, Mold.
	Pure Gold. Mr. J. F. Rees, M.R.C.V.S., 22 Lammas Street, Carmarthen.	Cardigan ...	Headquarters:—Aberystwyth ... Travels Tregaron, Lampeter, Llandyssil, Newcastle Emlyn, and Cardigan.	Lt.-Col. H. W. H. Brenchley, Glaneirw, Cardigan. Mr. D. Lloyd Lewis, Talfan, Lampeter, Cardiganshire. Sir E. J. W. P. Pryse, Bart., Gogerddan, Bow Street, Cardiganshire.
XI.	***Lousby.** Mr. J. F Rees, M.R.C.V.S., 22 Lammas Street, Carmarthen.	Carmarthen ...	Headquarters:—Carmarthen ... Travels Nantcaredig, Llanarthney, Dryslwyn, Llanfynydd, Llangadock, Llandilo, Kidwelly, St. Clears, Whitland, Llanboidy, and Mydrim.	Capt. D. C. S. Gwynne, Cilgwyn, Llangadock, Carmarthenshire. Mr. G. E. S. Protheroe-Beynon, Trewern, Whitland, Carmarthenshire. Mr. D. H. Thomas, Starling Park, Carmarthen.

tes the award of a Super Premium.

District Class.	Stallion and Owner.	Free Nominations.		Route	Stallion Committee.
		Counties to which allotted	Number allotted		
XI. *cont.*	**Neyland.** Mr. J. F. Rees, M.R.C.V.S., 22 Lammas Street, Carmarthen.	Pembroke ...	15	Headquarters:—Haverfordwest ... Travels Letterston, Narbeth, and Pembroke.	Mr. T. G. Phelps, Cresselly, Begelly, Pembrokeshire. Mr. R. H. B. Summers, Summerville, Haverfordwest. Mr. J. Walters, Southwood, Roch, Pembrokeshire.
	Harvest Money. Mr. F. R. Jeffery, Park Hill Stud Farm, Ipplepen, Newton Abbot.	Monmouth ..	15	Headquarters:—St Fagans, Cardiff ... . . . Travels Newport, Pontypool, Usk, Raglan, Abergavenny, and Chepstow.	Col. H. Lewis, Greenmeadow, Tongwynlais, Cardiff. Mr. A. M. Pilliner, Llanyravon, Newport, Mon. Mr. A. G. Burchardt-Ashton, The Priory, Llandogo, Chepstow.
XII.	**Thistledown.** The Compton Stud, Sandley, Gillingham, Dorset.	Gloucester ..	15	Headquarters:—Gloucester... ... Travels Berkeley Road, Stroud, Tetbury, Cirencester, and Badminton.	Major the Hon. L. Byng, Avening, Stroud, Gloucester. Mr. M. G. Lloyd Baker, The Cottage, Hardwicke, Gloucester. Col. F. Henry, Elmestree, Tetbury.
	Poor Beast. Mr. W. H. Bonner, King's Arms Hotel, Bicester.	Oxford —	15	Headquarters:—Bicester ... ... Travels Oxford, Witney, Burford, Charlbury, Woodstock, and Heyford.	Mr. F. H. Davenport, 62, St. Giles Street, Oxford. Mr. H. C. Jagger, M.R.C.V.S., Bicester. Mr. W. B. Millington, Deddington, Oxford.
	Richard the First. The Wigginton Stud, Wigginton, Tamworth.	Warwick ... Worcester ...	9 6	Headquarters:—Tamworth .. Travels Packington, Kenilworth, Leamington, Warwick, Henley-in-Arden, Hockley Heath, Redditch, Droitwich, and Worcester	Mr. J. P. Arkwright, Hatton House, Hatton, Warwick. Mr. T. M. Burman, Bragg's Farm, Shirley, Birmingham. Mr. R. Cottrill, Sandal Lodge, Droitwich. Mr. E. Ringer, M.R.C.V.S., Guy Street, Leamington.

XIII.	***Drummond's Pride.** Mr. J. Drage, Chapel Brampton, Northampton.	Northampton	15	Headquarters:—Chapel Brampton. Travels Market Harborough, Kettering, Thrapstone, and Wellingborough.	Mr. J. Brown, Earls Barton House, Northampton. Mr. E. Messinger, Chapel Brampton, Northampton. Mr. H. R. Roe, Cranoe, Market Harborough.
	***My Bird Sings.** Messrs. W. G. Maxwell and J. Heys, Yaxley, Peterborough.	Huntingdon ... Soke of Peterborough ...	10 5	Headquarters:—Peterborough ... Travels Huntingdon, St. Neots, Spaldwick, Kimbolton, and Ramsey.	Mr. A. G. Dilley, Market Hill, Huntingdon. Mr. G. Fuller, Manor House, Alconbury, Huntingdon. Mr. A. Jordan, Wistaria House, St. Neots.
	* † *Carrousel.* Mr. R. L. Fenwick, Little Belvoir, Melton Mowbray.	Leicester ... Rutland ...	8 7	Headquarters:—Little Belvoir ... Travels Melton Mowbray, Oakham, and Luffenham.	Mr. J. F. Cartmell, Manor House, Kirby Bellars, Melton Mowbray. Mr. R. C. Cooper, Waltham, Melton Mowbray. Mr. E. Guy Fenwick, North Luffenham Hall, Stamford. Mr. D Ward. Bescaby House, Melton Mowbray.
XIV.	**Explorer.** Mr. W. Charters, The Manor, Horringer, Bury St. Edmund's.	Suffolk ... ... Cambridge ...	10 5	Headquarters:—Horringer .. Travels Bury St. Edmund's, Ixworth, Stowmarket, Sudbury, Haverhill, Cambridge, and Fordham.	Mr. P. Brown, Rushbrook, Bury St. Edmund's. Mr. D. B. Ginn, Charterhouse Lodge, Grantchester, Cambridge. Mr. E A. Hudson, M.R.C.V.S., Barrow, Bury St. Edmund's. Mr. F. Stearn, Old Newton, Stowmarket.
	Macmurrough. Mr. E. H. Barlow, Sigsworth, Pateley Bridge, Yorks.	Suffolk	15	Headquarters.—Woodbridge Travels Ipswich, Manningtree, Saxmundham, and Beccles.	Mr. J. C. Dawson, Nacton, Ipswich. Mr. J. Keeble, Branthram Hall, Manningtree. Mr. R. E. Walford, Hasketon, Woodbridge.
XV.	**Cock of the Walk.** Mr. D. Fraser, Tickford Park, Newport Pagnell.	Buckingham. .	15	Headquarters:—Newport Pagnell. Travels Cosgrove, Hanslope, Stony Stratford, Buckingham, and Fenny Stratford.	Mr. F. W. Coales, Lathbury, Newport Pagnell. Mr. M. Grimes, Tickford Park Stud, Newport Pagnell. Mr. C. D. Pennant, Lillingstone Dayrell, Buckingham.

* Indicates the award of a Super Premium.

† This stallion died before serving any mares, and the Board accepted "Border Prince" as substitute.

District Class	Stallion and Owner.	Free Nominations.		Route.	Stallion Committee.
		Counties to which allotted.	Number allotted.		
XV. *cont.*	**Tasso.** Mr. H. Arnold, Crews Hill Paddocks, Enfield, Middlesex.	Hertford ... Essex ... ... Middlesex ...	7 5 3	Headquarters :—Enfield ... ... Travels Barnet, St. Albans, Hatfield, Hertford, Ongar, Epping, and Waltham Abbey.	Mr. J. Bell, Cattlegate Farm, Enfield, Middlesex. Lt.-Col. B. J. Gripper, The Drill Hall, Hertford. Mr. J. C. McCowan, Hatfield. Mr. A. Waters, Coopersale Lodge, Epping.
XVI.	*** Hanover Square.** Sir Merrik R. Burrell, Bart., Knepp Castle, Horsham.	Sussex (West)	15	Headquarters :—Knepp Castle, Horsham. Travels West Grinstead, Steyning, Washington, Storrington, Petworth, and Billingshurst.	Mr. E. Brown, Stud Farm, Knepp Castle, Horsham. Mr. A. G. Hecks, Manor Farm, Sullington, Pulborough. Mr. J. B. Watson, Estate Office, Petworth.
	Rockaway. Mr. C. Kelway-Bamber, Priestlands, Horley, Surrey.	Kent ... ... Surrey	8 7	Headquarters :—Horley ... ... Travels East Grinstead, Tunbridge Wells, Tonbridge, Sevenoaks, Maidstone, and Redhill.	Mr. G. C. G. Leveson Gower, Titsey Place, Limpsfield, Surrey. Mr. W. G. Lambarde, Bradbourne Hall, Sevenoaks. Mr. C. Murdoch, Wester Hill, Linton, Maidstone. Mr. E. Murray, M.F.H., The Old Cottage, Mickleham, Dorking.
XVII.	**Liao.** Mr. J. E. A. Willis-Fleming, Chilworth Manor, Romsey.	Southampton	15	Headquarters :—Chilworth ... ... Travels Romsey, Cadnam, Fordingbridge, Ringwood, Christchurch, Lymington, Beaulieu, and Totton.	Lord Arthur Cecil, The Mount, Lymington. Mr. G. Lander, Purewell, Christchurch. Mr. G. H. Morgan, Beaulieu, Brockenhurst, Hants. Mr. Keppel Pulteney, "St. Austins," Lymington. Mr. T. Stovold, Bransgore, Christchurch.
	Erisgeir. The Compton Stud, Sandley, Gillingham, Dorset.	Berks ... ... Wilts	10 5	Headquarters :—Abingdon ... ... Travels Wantage, Shrivenham, Swindon, Highworth, Buscot, Faringdon, and Kingston Bagpuze.	Major H. G. Henderson, M.P., Kitemore, Faringdon. Mr. J. L. Nickisson, Hinton Manor, Swindon. Mr. E. Robson, Stockham, Wantage.

XVIII.	**Glenrossall.** Mr. T. K. Bickell, Stud Farm, Lamerton, Tavistock.	Somerset	15	Headquarters:—Wellington ... Travels Wiveliscombe, Crocombe, Taunton, Ilminster, and Chard.	Mr. J. C. Hally, M.R.C.V.S., Wellington, Somerset. Mr. C. L. Hancock, Manor House, Cothelstone, Bishop's Lydeard, Taunton. Mr. Basil Syres, Holyrood House, Chard.
	FitzDonovan. The Compton Stud, Sandley, Gillingham, Dorset.	Wilts	15	Headquarters:—Chippenham ... Travels Wootton Bassett, Hilmarton, Calne, Devizes, and Melksham.	Mr. J. Gwatkin, Manor House, Potterne, Wilts. Mr. W. L. Lysley, Motton, Lacock, Chippenham. Mr. V. T. Taylor, Steinbrook House, Chippenham.
	Jacobite. The Compton Stud, Sandley, Gillingham, Dorset.	Somerset ... Dorset	9 6	Headquarters:—Sandley ... ... Travels Shepton Mallet, Frome, Yeovil, and Glastonbury.	Mr. A. C. Clarke, Red Lion Hotel, Shepton Mallet. Capt. G. Phipps Hornby, Somerton Erleigh, Somerton, Somerset. Major A. L. Langman, C.M.G., Hazlegrove, Sparkford, Bath.
	Knightly. Mr. T. J. Hillman, Stud Farm, Stock Wood, Redditch.	Somerset ...	15	Headquarters:—Keynsham ... Travels Bath, Midsomer Norton, Wells, Cheddar, Highbridge, and Weston-super-Mare.	Mr. L. B. Beauchamp, Norton Hall, Bath. Mr. E. A. Hardwick, Springfield House, Worle, Weston-super-Mare. Mr. W. A. Pillers, Keynsham, Bristol. Mr. H. A. Tiarks, Webbington House, Axbridge, Somerset.
XIX.	* **Golden Grebe.** Messrs. W. & H. Whitley, Primley Farm, Paignton.	Cornwall ... Devon	10 5	Headquarters:—Paignton ... ... Travels Totnes, Liskeard Bodmin, Plympton, Ivybridge, and Brent.	Mr. C. Burleigh, Coldrenick Farm, Menheniot, Liskeard. Mr. E. W. Hawker, The Chantry, Ivybridge, Devon. Mr. A. Hingston, Jnr., Totnes.
	Marzio. Mr. M. J. Taylor, Ermington, Ivybridge, Devon.	Devon	15	Headquarters:—Ermington ... Travels Newton Abbot, Dawlish, Exeter, Bideford, and Torrington.	Mr. M. W. Ball, Highclose, Newton Abbot. Mr. C. R. Bruce, The Glen, Buckland Brewer, Bideford. Major L. C. Garratt, Clyst St. Mary, Exeter, Mr. W. B. Nelder, F.R.C.V.S., 33 Paul St., Exeter.
	Golden Petrel. Mr. T. K. Bickell, Stud Farm, Lamerton, Tavistock.	Devon	15	Headquarters:—Tavistock ... ... Travels Okehampton, Crediton, Tiverton, and Dulverton.	Mr. I. M. H. Amory, Hensleigh, Tiverton. Mr. R. W. Fox, Grimstone, Horrabridge, Devon. Mr. E. P. Northey, Higher Bowden, Okehampton.

* Indicates the award of a Super Premium.

OFFICIAL NOTICES AND CIRCULARS.

Report on Experiments in the Cultivation of Sugar Beet in 1911.

With a view to obtaining information on certain points in regard to the cultivation of sugar beet, the Board made arrangements for a series of experiments to be carried out in 1911 at seven centres in England. The main objects in view were to obtain precise information as to the best methods of preparing the land, of sowing the seed, and of manuring, and to ascertain the approximate cost of producing beet ready for delivery to a sugar factory. The experiments were conducted under the superintendence of members of the staffs of the following Agricultural Colleges and Schools:—The South-Eastern Agricultural College, Wye; the Midland Agricultural College, Kingston, Derby; the Harper-Adams Agricultural College, Newport, Salop; the Royal Agricultural College, Cirencester; the Essex County Technical Laboratories, Chelmsford; the Seale-Hayne Agricultural College, Newton Abbot; the Agricultural Institute, Ridgmont, Bedfordshire.

A report on these experiments has been issued by the Board [Cd. 6162] and may be obtained from Messrs. Wyman and Sons, Ltd., Fetter Lane, E.C., price 5*d.* The report summaries the results obtained as regards yield per acre, percentage of sugar, methods of cultivation, rates of seeding, variety tests, and cost of cultivation. Reports by the various colleges, and tables showing the results of the examination of samples from the colleges at the Government Laboratory are given in appendices to the report.

These experiments, it may be explained, were not designed, nor expected, to answer conclusively the question whether sugar beet can be profitably substituted for other descriptions of root crops. The price which a sugar factory would be able to pay the farmer for his beet cannot be predicted with confidence, while, on the other hand, it is equally uncertain what amount will offer a sufficient inducement to the farmer to abandon his customary root-crop in favour of sugar beet. This amount depends on conditions which vary from one locality to another. There is no question that beet with a high sugar content can be grown in this country and give yields equalling, if not exceeding, those obtained on the continent, and the information given in this report shows that farmers who wish to form their own opinion on the comparative merits of beet and other root crops may, without difficulty and at little cost, grow the crop for themselves.

Bovine Tuberculosis.

The Board of Agriculture and Fisheries are anxious to secure the co-operation of agriculturists in connection with an inquiry which the Board desire to conduct with reference to the subject of bovine tuberculosis. It is within the knowledge of the Board that certain stock-breeders are privately carrying out independent investigations and experiments with a view to the elimination of tuberculous cattle from their herds, and the Board are under the impression that a considerable number of such private experiments may have been carried out or undertaken which have not come to their knowledge. The Board desire, both for their own guidance and in the public interest, to make a comprehensive survey of any such experiments which have been undertaken, with a view to the examination and collection of the results and their comparison with the results of analogous experiments conducted through official and semi-official agencies. The Board hope that it may be possible by means of the data thus obtained over a wide field of observation to draw conclusions of much importance, not only to those immediately interested in such investigations, but also to the agricultural community as a whole.

In these circumstances the Board would be glad if any persons who would be prepared to place the results of their experiments confidentially at the disposal of the Board, would communicate with them in the matter. It is of great importance that the records submitted for investigation should be complete and unambiguous, and the Board would send to all such persons a schedule of the points upon which it is desirable that information should be furnished.

Communications on this subject may be addressed under private cover to the Board's Chief Veterinary Officer, Mr. S. Stockman, M.R.C.V.S., 4 Whitehall Place, London, S.W. Any such communications will, if so desired, be considered in the strictest confidence; and a similar confidence will be observed when desired (by the suppression of the names of persons, places, &c.), in the preparation of any reports that it may be considered advisable to publish thereon.

Report of Proceedings under the Tithe and other Acts during 1911.

The Annual Report of the Board of Agriculture and Fisheries of proceedings under the Tithe, Copyhold, Inclosure, Commons, Land Drainage, and other Acts for the year 1911 has recently been issued [Cd. 6150, price 2½*d.*], and may be obtained from Messrs. Wyman and Sons, Ltd., Fetter Lane, E.C.

American Gooseberry Mildew.

The Board of Agriculture and Fisheries received information that the summer stage of American Gooseberry Mildew (*Sphaerotheca Mors-uvae*) was discovered in a Cambridgeshire garden on the 15th April. All gooseberry growers are advised to examine their bushes carefully, and should any sign of disease be found, to spray their bushes with a solution of liver of sulphur (one pound to 32 gallons of water). A leaflet describing the disease and giving directions for dealing with it can be obtained from the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W., gratis and post free. Letters so addressed need not be stamped.

Growers are reminded that by Article 3 of the American Gooseberry Mildew Order of 1911 they are required to report the presence of this disease on their premises to the Board or the Clerk of the Local Authority for the district, either directly or through an Inspector, and that the failure to report is punishable by a fine.

Notes on the Weather in April.

The weather during April, taking the month as a whole, was characterised by unusual warmth, light rainfall, and abundant sunshine.

The conditions during the *first* week (March 31st to April 6th), however, were not so fine as in succeeding weeks. Warmth was "moderate" in Scotland N. and W., and in England S.E. and S.W., but "unusual" everywhere else. Rainfall was "light" in England N.E. and the Midland Counties, "heavy" and "very heavy" in Scotland W. and N. respectively, and "moderate" in other districts. Sunshine was "abundant" only in England S.E.

During the early half of the *second* week the conditions were very unsettled, with rain or passing showers in all districts, but the later days of the period were generally fair or fine. As a rule, taking the week as a whole, "moderate" warmth, and "light" rainfall were experienced. Bright sunshine was above the average in the eastern districts, and in England N.W., but below it elsewhere.

In the *third* week, "very unusual" warmth was recorded in Scotland E., and "unusual" warmth in all other districts. As regards rainfall, in England S.E. alone of the English districts was any rain at all recorded, while in Scotland N. and W. the fall was light, and no rain fell in Scotland E. Bright sunshine exceeded the normal in all districts.

The general conditions remained very fine and dry throughout the *fourth* week, but some rain was experienced in Scotland early in the week. Warmth was "very unusual" in Scotland E. and W. and England N.W. and S.W., and "unusual" in other districts. No rain fell during the week over the whole of England, and the fall in Scotland was "light" or "very light." "Very abundant" sunshine was recorded everywhere, except in Scotland E. and N., where it was "abundant."

Agricultural Conditions in Great Britain in April.

The Crop Reporters of the Board, in reporting on agricultural conditions on May 1st, state that the continued dry weather during the month, together with the cold winds and night frosts, has adversely affected the growth of the crops, and rain and warmer weather are much needed. The conditions prevailing, following upon the wet weather in March, rendered the preparation of seed beds difficult on the heavy soils. Wheat is generally looking well, except upon heavy wet land, where it is turning colour. The sowing of barley and oats in some parts of the Midlands and in the north of England was not completed at the date of the reports, and in the west of Scotland a good deal of barley was still to be got in. Early-sown barley and oats are for the most part looking well, but the later sown is backward and rain is needed to promote germination. Winter beans are fairly promising, though they have been badly cut by frost in some localities in the Midlands. Peas are coming up fairly well, but are backward.

Considerable progress has been made with the planting of potatoes, the weather having been favourable for this work, which is generally well advanced, except on heavy soils in parts of Lincoln, and the East Riding. Early varieties have been injured by frost in some districts of the eastern division and the Midlands.

The progress of mangold sowing has varied considerably even in the same division. In some parts half the work has been done, in others none have yet been sown, owing to the difficulty experienced in procuring a good tilth. Rain is badly required for that which is already sown.

There has been an exceptional abundance of blossom on all fruit trees, with a promise of good crops, though severe frosts on April 10th and 11th badly affected plum trees and early pears in central and south Worcester, and in other fruit-growing districts plums have suffered to some extent. In south Kent gooseberries have also been injured by frost.

With some exceptions, in the northern division of England, in the west of Scotland, and in Wales, where they are healthy and vigorous, clover and seeds are generally described as a poor and thin plant, the growth having been checked by the ungenial weather of the month.

Owing to the shortness of keep and the rapid growth of grass, during the mild, open weather of the beginning of the year, stock were early turned out on the pastures; but the growth of grass has been arrested during the month, and, except in the south-west of England and the west of Scotland, pastures are generally becoming bare. The condition of stock varies considerably, and is frequently unsatisfactory owing to the shortness of keep, especially in the north-east division of England. In Scotland stocks of all classes have thriven well.

Lambing is for the most part over, except among the mountain flocks, with varying results as to the fall of lambs, which appears generally below the average. In the east and north-east of England lambs and ewes are generally in poor condition owing to the shortage of keep. In south Dorset the season has been bad, and the mortality amongst Dorset Horn ewes particularly heavy, and in the North Riding heavy losses have occurred amongst both ewes and lambs. In Wales there has been a good lambing season, with an over-average fall and less mortality than usual. In Scotland the fall is rather under the average, and the losses generally small, while lambs are healthy and making good progress.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for April, 1912, issued by the International Institute of Agriculture, states that winter cereals throughout Europe are generally in satisfactory condition, but in France and Germany some of the crops came on so quickly during the moist weather that lodging is feared. Night frosts have, however, delayed development in some countries.

In *Germany* the condition of winter wheat was stated to be 2·3 and winter rye 2·2 on April 1st (2=good, 3=average). The condition of wheat and rye in *Austria* on April 1st was estimated at 2·0 and 1·8 respectively (1=very good, 2=good, 3=average). Wheat is estimated at 83, rye 78, and barley 75 in the *Netherlands*, where the scale used is 100=excellent, 90=very good, 70=good. The condition of wheat in *Denmark* promised only 91 per cent. of an average crop on April 1, as compared with a promise of 99 per cent. a month earlier. In *Belgium, Bulgaria, Hungary, Roumania,* and *Switzerland* the autumn-sown crops are reported to promise average or over average crops, wheat, rye, and barley all promising excellent crops in Bulgaria and Roumania.

In the *United States* winter wheat promises 6½ per cent. and winter rye 2½ per cent. less than an average crop. The condition of both wheat and barley in *Japan* is poor.

Spring Sowing.—Favourable weather for field work and spring sowing has been experienced in Germany, Belgium, France, Switzerland, Italy, Bulgaria, and Roumania. In Austria, Hungary, and Denmark spring sowing has been delayed by wet and stormy weather.

Australia.—The final returns of the wheat harvest are as follow:—Area, 7,442,000 acres; production, 9,096,000 qr.; yield per acre, 9·8 bush.

Japan.—According to the final returns of the harvest of 1911, 3,105,000 qr. of wheat were produced, 5 per cent. more than in 1910; barley, 11,401,000 qr., 6 per cent. more; and oats, 453,000 qr., 3½ per cent. more than in 1910.

United States.—The *Northwestern Miller* cables that seeding is well advanced in the spring wheat States, and that conditions are favourable. In Kansas, crop reports are improving; estimates are for a yield of about 92 million bush., against 51 million last year, and 62½ million in 1910. In Missouri and Illinois the crop has been impaired, but the weather is now more favourable. In the Ohio Valley reports are conflicting, but doubtless damage has been done. The *Cincinnati Price Current* cables that a large area has been abandoned, but is being partly re-seeded. Spring wheat is more favourable than a year ago, but can hardly be expected to balance the certain loss on winter wheat. (*Beerbohm's Evening Corn Trade List,* April 26th.)

The Washington Bureau report issued yesterday shows the condition on May 1st of winter wheat to be better than anticipated, being barely 1 per cent. under that of last month, but the average is 6·6 per cent. worse than a year ago, while the area abandoned of sowings (6,469,000 acres) equals 20·1 per cent.—probably the largest on record. The principal losses of acreages were in Illinois, Indiania, and Ohio. Present indications are for a crop of 385,000,000 bush., compared with 430,656,000 bush. harvested last year. (*Dornbusch,* May 8th.)

Canada.—The weather, on the whole, has continued favourable for all agricultural operations, and sowing is proceeding rapidly; the area sown is expected to be fully equal to that of last year. (*Beerbohm's Evening Corn Trade List,* April 26th.)

Russia.—H.M. Consul-General at Odessa reported on April 17th that the winter in South Russia set in rather late. The weather was changeable, but there were no such extremes of temperature as to do much harm to the young crops, and where frost was most severe the snow covering was most complete. Spring is setting in late and gradually, windy weather and cold nights keeping vegetation back, but the crops appear to have come through the winter satisfactorily. They are generally more satisfactory in the western than in the eastern part of the district.

H.M. Vice-Consul at Nicolaieff states, in a despatch dated April 4th, that the winter-sown grain crops are in good condition. The winter was not severe, and good falls of snow have left plenty of moisture. Spring crops are now being got in under good conditions.

Holland.—H.M. Consul at Rotterdam reports that the Dutch Ministry of Agriculture, under date of April 8th, states that, on the whole, it is anticipated that good crops of *wheat, rye,* and *barley* will be forthcoming. *Grass fields* are in excellent condition, and afford abundant pasture for cattle, which were turned out very early in the year, though the growth of grass is now retarded by cold winds. The area under *clover* is considerably smaller than in normal years. Reports on the crop are good in the south-west and less favourable in the north-east.

Germany (Official).—The weather during the past week continued unfavourable to cereals and feeding stuffs and the interruption in the development of vegetation is practically general, while it is even feared that crop conditions have suffered. Only since May 3rd rains are falling in some parts of North Germany. As to winter sowings, *rye* appears to have suffered most through the adverse climatic conditions, while *wheat* was less affected, but the latter cereal cannot much longer resist the inclement weather. Early spring sowings have made a good start, while later ones are checked in their development by cold weather. *Oats* are reported to have suffered in many instances, while for the planting of *potatoes* and sowing of *turnips* the dry weather was rather favourable. (*Dornbusch,* May 6th.)

Prospects of Fruit Crops in California.—H.M. Consul-General at San Francisco reports, in a despatch dated April 10th, that except for the probable bad effects of the light seasonal rainfall, prospects for a large crop of fruit are good. Danger from frosts is not yet over, but the ravages of insect pests and plant diseases have not been unusually severe. The almond bloom was heavy, and the set so far appears to be excellent, although some frost damage has been reported. Apple bloom bids fair to be excellent, and there appears to be abundant moisture in the larger apple-growing sections. Reports as to apricots vary, the bloom in many districts being light, and considerable damage by frost is reported. There is every indication of a good cherry crop. The outlook for a good-sized peach crop would be encouraging except for the lack of moisture in some sections. The bloom is heavy, and the set appears to be good. The bloom and set of shipping plums appear to be good in most districts. The prune bloom is remarkably heavy, and the damage by thrips has not been excessive.

Live Stock Census in Croatia and Slavonia.—The following table gives a comparison of the results of the live stock census in Croatia and Slavonia taken in March, 1911, with those of the previous census of December, 1895 (*Bulletin of Agricultural Statistics,* April, 1912):—

	Census of		Increase (+) or Decrease (−).	
	1911.	1895.	Actual.	Per cent.
Horses	350,036	311,359	+38,677	+12·4
Asses and mules	3,173	3,485	−312	−9·0
Cattle	1,134,664	908,780	+225,884	+24·9
Pigs	1,163,493	882,973	+280,520	+31·8
Sheep	850,161	595,902	+254,259	+42·7
Goats	95,592	22,418	+73,174	+326·4

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on May 1st, 1912, certain diseases of animals existed in the countries specified:—

Austria (for the period April 17th—24th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 611 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period March 1st—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (23 "foyers" in 21 "communes"), Rabies.

Bulgaria (for the period April 6th—14th).

Anthrax, Glanders and Farcy, Rabies, Swine Fever.

Denmark (month of March).

Anthrax, Foot-and-Mouth Disease (132 cases), Swine Erysipelas.

France (month of March).

Anthrax, Blackleg, Foot-and-Mouth Disease (687 "étables" in 421 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period April 1st—15th).

Foot-and-Mouth Disease (2,103 infected places in 948 parishes), Glanders and Farcy, Swine Fever.

Holland (month of March).

Anthrax, Foot-and-Mouth Disease (62 outbreaks in 8 provinces), Foot-rot, Glanders and Farcy, Rabies, Swine Erysipelas.

Hungary (for the period April 3rd—10th).

Anthrax, Foot-and-Mouth Disease (total of 27 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period March 11th—17th).

Anthrax, Blackleg, Foot-and-Mouth Disease (51 new cases entailing 754 animals), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period March 1st—15th).

Foot-and-Mouth Disease (13 "étables" infected in 5 "communes"), Glanders and Farcy.

Norway (month of March).
Anthrax, Blackleg, Swine Fever.

Roumania (for the period March 21st—29th).
Anthrax, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (Month of January).
Anthrax, Foot-and-Mouth Disease (2,866 animals in 100 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period March 30th—April 6th).
Rabies.

Spain (month of February).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (59,327 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of March).
Anthrax, Blackleg; Foot-and-Mouth Disease (7 outbreaks), Swine Fever.

Switzerland (for the period April 15th—21st).
Anthrax, Blackleg, Foot-and-Mouth Disease (25 "étables" entailing 361 animals, of which 7 "étables" were declared infected during the period), Swine Fever.

Agricultural Labour in England during April.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in April:—

The weather during April was exceptionally dry, and most agricultural labourers were in regular employment. Men were wanted outside the regular farm staff for such work as potato planting, preparing the land for the root crops, carting and spreading manure, and hoeing corn. The hard state of the land somewhat reduced the demand for these extra men in many districts by rendering hoeing backward, and in some districts, particularly in the eastern counties, there was an over supply. There was still some scarcity of men for permanent situations in parts of the Midland and Southern and South-Western Counties.

Northern Counties.—The supply of extra labourers was generally equalled by the demand in these counties throughout April. The demand for such men was small in *Northumberland* and *Durham,* but in the other counties it was fairly good, on account of such work as potato planting, carting and spreading manure, cleaning the land for the root crops, and hedging. There was some scarcity of men for permanent situations in the Sherburn (*Yorkshire*) Rural District, while a demand for cowmen was reported in the Doncaster Rural district in the same county.

Midland Counties.—The continuous dry weather, while affording regular employment to most extra labourers in these counties, somewhat curtailed the employment of some by rendering the land too hard for hoeing. A surplus of men was reported in several districts, including parts of the Hayfield (*Derbyshire*), Melton Mowbray (*Leicestershire*), and Buckingham Rural Districts. There was still some scarcity of men for permanent situations in certain districts in the Bucklow (*Cheshire*), Pershore and Upton-on-Severn (*Worcestershire*), and Crowmarsh (*Oxfordshire*) Rural Districts.

Eastern Counties.—Extra labourers were in demand for carting and spreading manure, preparing the land for the root crops, threshing, potato planting, and hoeing corn. Fewer men than usual, however, were wanted for hoeing on account of the dry weather, and some men of this class were consequently unemployed in the Bourne (*Lincolnshire*), Henstead, and Swaffham (*Norfolk*), Thingoe (*Suffolk*), and Orsett and Saffron Walden (*Essex*) Rural Districts. In the Spilsby (*Lincolnshire*) Rural District a scarcity of extra men was reported.

Southern and South-Western Counties.—Some time was lost by extra labourers, as in other parts of the country, through the effect of the dry weather on the land, but employment generally was fair, and mention of any marked surplus of men was exceptional in the reports. Correspondents in the Winchester (*Hampshire*), Tisbury (*Wiltshire*), and South Molton (*Devonshire*) Rural Districts reported an insufficient supply of such men. There was some scarcity of men for permanent situations in parts of the Godstone (*Surrey*), Chailey and Petworth (*Sussex*), Wantage (*Berkshire*), Chippenham and Tisbury (*Wiltshire*), Bromyard and Hereford (*Herefordshire*), Kingsbridge and Newton Abbot (*Devonshire*), and Camelford (*Cornwall*) Rural Districts.

THE CORN MARKETS IN APRIL.

C. KAINS-JACKSON.

Wheat.—Easter this year made little difference to the exchanges, which at the time were too much concerned over securing delivery in spite of the coal strike to take any appreciable vacation. The difficulties were, on the whole, solved more readily than might have been anticipated, but the milling and baking interests went through a period of much anxiety. Since Easter the weather has been spring-like and fine, so that retail requirements of breadstuffs were moderate and not as they sometimes are in April, on a winter level. Stocks therefore have not been further reduced beyond the decidedly low figures at which they stood at the Eastertide adjournment. They are now about twelve hundred thousand quarters in the fifteen chief ports; average holdings for the first decade of the new century are about two and a half millions, but the tendency of the period has probably been to reduce the stores in warehouse, so that the present figures are not spoken of with that apprehension which their small total would have inspired ten years back. During the last fortnight of April business came more and more to a trading cleavage between the finer, harder, and stronger sorts of wheat, which were in diminishing supply, and fetched increasing prices, and the inferior produce, which, with augmented arrivals, hardly maintained former value.

There are exceptionally large supplies of Canadian wheat of indifferent grade. The absence of No. 1 Manitoba from the London market, and the extreme scarcity which drove No. 2 Manitoba to 45*s*. per quarter, were evidence of the situation. At the very end of April the closing of the Dardanelles caused delay in prospective supply of strong wheat from Russia, and enabled the holders of good Russian to obtain 6*d*. to 1*s*. more money for anything admitting of prompt delivery to the mill. April shipments were 855,000 qr. from North America, 1,990,000 qr. from South America, 517,000 qr. from Russia, 936,000 qr. from Europe S.E., 347,000 qr. from India, and 686,000 qr. from Australia. The considerable shipping efforts made by Roumania, Servia, Bulgaria, and European Turkey did much to reduce the feeling of scarcity caused by Russia's small exports, which were about twelve hundred thousand quarters less than for April, 1911.

The supply of wheat on passage at the end of the month was a little over four million quarters. It included a disproportionate quantity of softish Australian and Californian, and of rather poor grade Argentine, while Russian, Roumanian, Canadian, American winter, and Chilian were favoured types of which the arrivals in prospect were very short indeed. There seems no American spring in sight at all. Indian is the one good all-round sort which is in full supply on passage, but it is old crop, and will be found, if like that of other seasons, to be not exempt from weevils. Shipments of the new crop, which happily seems to be an excellent one, are only just beginning. Vendors for prompt shipment get 40*s*. per 492 lb. for fair average quality. Red is scarcely below white in present selling price. April closed with British wheat averaging 37*s*. 10*d*. per 480 lb., with No. 3 Manitoba at 42*s*. 6*d*. per 496 lb., with white Calcutta at 41*s*. 3*d*. per 492 lb., with f.a.q. Argentine at 40*s*. per 480 lb., with the best Russian at 45*s*., and with f.a.q. at 42*s*. 6*d*. per 496 lb. These are spot prices; for the American new wheat crop, winter sort, an average quality, 7*s*. 9*d*. per cental, September shipment, was asked and obtained.

Flour.—It is commonly stated that it costs a shilling in coal to grind a sack of flour in a modern steam-roller mill. However that may be, the increase of 50 per cent. in the cost of coal, led in early April to all flour prices being put up 6*d*., and this moderate action of the millers quickly proved insufficient, as the difficulties of delivering to the bakers became acute through railway refusals of heavy traffic and consequent need of costly road delivery. Millers are more and more, however, using the road, and haulers, motor lorries, &c., are increasingly in evidence. The price of London flour at the end of the month was 34*s*. 6*d*., both for "London Top-price" and for "Town Whites," but the former is quoted "cash," the latter credit and delivery terms. Town Households were steady at 30*s*. ex mill, American wheat ground in the London mills made 32*s*. to 33*s*., imported American fine 31*s*. to 32*s*., and 17*s*. to 28*s*. best bakers' grades. An excellent demand was reported for by-products of the mill. Fine middlings commanded 8*s*. per cwt. cash, and the finer sorts of bran made 6*s*. 6*d*. to 6*s*. 9*d*. per cwt. North America during April shipping only 360,000 sacks, and other exporters doing very little, the total on passage on the 30th was found to be down to 174,000 sacks.

Barley.—The demand for seed corn lasted longer than usual, samples at 44*s.* to 45*s.* per 448 lb. being in request up to the full middle of the month. But this sale is, of course, now over, the malting season likewise has finished, and averages below 30*s.* at Cambridge, Lincoln, and some other leading centres witnessed to the increased proportion of 400 lb. sorts offering. All English barley, however, is now scarce. As the month wore on Russian became scarce also, and the month's total imports are among the smallest recorded in the course of the past fifty years. Russian having risen to 30*s.* per 400 lb., through this drying-up of the supply, feeding corn has been sought, not merely in India and Burma, but in Mexico, Morocco, and other unusual quarters. These new supplies follow at an interval of 1*s.* to 1*s.* 6*d.* per qr. behind the Russian type, which sets the price. They therefore may be given at 28*s.* 6*d.* to 29*s.* per 400 lb. The month closed with only 125,000 qr. on passage from all quarters, viz.:—20,000 Chilian, 80,000 Indian and Persian, and 20,000 all other countries, chiefly Mexico, Morocco, Tunis, and Anatolia. Shipments for April were 553,000 qr. from Russia, 114,000 qr. from Europe S.E., and 120,000 qr. from India, Burma, and Persia.

Oats.—Good heavy oats of home growth have commanded not less than 3*s.* per bush., and have sometimes reached 26*s.* per 336 lb. The supply seems smaller than usual at all the chief markets. Imported oats rose in mid-April to a guinea per 304 lb., but large exports from Argentina in the last half of the month induced spot holders to take somewhat different views by the 29th, when Mark Lane witnessed 6*d.* decline in the 304 lb. descriptions. The month's imports, however, were about 150,000 qr. less than current requirements, and stocks are cut down to so low a figure that the 600,000 qr. on passage are not exciting any fear of a "slump." The month's shipments were 24,000 qr. from Canada (these oats fetch 23*s.* to 24*s.* here), 1,173,000 qr. from South America, 383,000 qr. from Russia, and 66,000 qr. from Europe S.E.

Maize.—The imports of April were a bare half of estimated requirements, though this was far from being the principal trouble of the market for this product. The grain which actually did come to hand was found to vary in quality, cleanliness, condition, &c., to a much greater degree than usual. Extreme care has therefore had to be exercised in buying, and corn chandlers complain that they are frequently unable to supply their customers with that clean and level corn that the latter are demanding. On the 29th 34*s.* was freely paid for the best. The Russian maize ranged from 27*s.* to 33*s.*, and American from 28*s.* to 32s. Argentina was offering, as the month closed, to ship in June at 5*s.* 9*d.* per cental, but this is 2*d.* advance on the month, and the situation was a very difficult one for those with contracts for early summer delivery. April shipments of this grain were 218,000 qr. from the United States, 132,000 qr. from Argentina, 219,000 qr. from Russia, and 854,000 qr. from Europe S.E. There were on the 30th 295,000 qr. on passage, a total much below what buyers would wish to see.

Oilseeds.—The month has reduced the supplies on passage both of linseed and cottonseed, and they now stand at 125,000 qr. and 27,000 tons respectively, against 177,000 qr. and 48,000 tons on March 31st. Indian linseed for prompt shipment has risen from 60*s.* to 64*s.* per

410 lb., and Argentine from 57*s.* to 60*s.* per 416 lb. The early purchasers of new crops for spring and early shipment have done uncommonly well. London is a stiffer market than Hull, its imports of linseed since January 1st showing nearly 20 per cent. decrease on the year, whereas those of Hull show 7 per cent. increase. The cottonseed shipments of India this season thus far have been practically identical with those of last season, almost exactly a hundred thousand tons in either case. From Egypt they have been, to this country, 261,000 tons, against 275,000 tons. The cash price for cottonseed is now 9*s.* per cwt. for Egyptian, and 7*s.* 6*d.* per cwt. for Indian.

Various.—Beet sugar on the month shows 7*d.* per cwt. decline. At 13*s.* 9*d.* it is in improved request. Small pulse is looked up, but buyers must be very careful what they purchase, as the names under which samples are offered vary in a surprising manner. It seems hopeless to look for sale under the botanical names. The chickpeas offering from the Levant seem to be identical with the so-called gram from India. Samples of "Kaffir corn" from South Africa present a close analogy with Argentine sorghum. All that need here be said of price is that the smaller sorts of pulse, dari, millet, &c., have had ready buyers at 6*s.* per cental, and the bolder descriptions, those of larger grain, have commanded 7*s.* per cental without difficulty.

THE LIVE AND DEAD MEAT TRADE IN APRIL.

A. T. MATTHEWS.

Fat Cattle.—In all the circumstances relating to the agricultural conditions of last year, the steady advance in the value of British cattle since Christmas has caused no surprise in market circles, for an even greater shortage than that which has occurred was generally expected. The returns show that the supplies in forty-one British markets during the week ending April 25th were only about 7 per cent. less than the average of the same week in the preceding three years. The opinion was freely expressed by salesmen of great experience in the Metropolitan market that the best cattle would touch 9*d.* per lb. before May 1st. They have not quite done so, but a few choice Scots have actually been sold at Islington at 8¾*d.* per lb.

In the English markets, Shorthorns during the past month advanced about ¼*d.* per lb., as compared with the prices of March, and all other breeds by a similar amount, as shown by the following averages:—Shorthorns realised 9*s* 2*d.* for first, and 8*s.* 4*d.* for second quality, against 8*s.* 11*d.* and 8*s.* 1*d.* in March; Herefords, 9*s.* 4*d.* and 8*s.* 8*d.*, against 9*s.* and 8*s.* 4*d.*; Devons, 9*s.* 3*d.* and 8*s.* 3*d.*, against 8*s.* 11*d.* and 7*s.* 11*d.*; and Polled Scots, 9*s.* 4*d.* and 8*s.* 8*d.*, against 9*s.* 2*d.* and 8*s.* 5*d.* In the first two weeks, Welsh Runts averaged 9*s.* 3*d.* and 8*s.* 6*d.*, but since then very few have been on offer.

As the month drew to an end the trade received a sharp check, which was attributed to the warmer weather, and there is no doubt that in the coming weeks the amount of rainfall and the state of the pastures will have a controlling effect on market values.

Veal Calves.—The demand for fat calves was very fair, and average prices at all the principal markets improved slightly at 9½*d.* per lb. for first, and 8*d.* for second quality. There was, however, a difference of 2*d.* per lb. between the highest and lowest markets.

Fat Sheep.—Although the numbers of sheep coming to market have exceeded the average of the last three years, they are weighing so badly that the total weight of mutton is much less than appears to be the case. Prices again advanced, and Downs in the wool averaged 10*d.*, 9¼*d.*, and 7¼*d.* for the three qualities, or ½*d.* per lb. more than in March, while Longwools averaged 9¼*d.*, 8¼*d.*, and 6¾*d.*, against 9*d.*, 7¾*d.*, and 6¼*d.* in March. Clipped Downs sold well, and averaged 8½*d.*, 8*d.*, and 6½*d.*, while Longwools, a larger proportion of which were clipped, averaged 8¼*d.*, 7½*d.*, and 5¾*d.* per lb. Cheviots and Scotch cross-breds in English markets, though coming out in better condition, rarely exceeded in value the best Downs. In the last week there was a decided weakening tendency in many markets, notably at Ipswich and Wellington (Salop), where prices for Downs in the wool declined ¾*d.* and ½*d.* per lb. respectively, while the general average was less by about ¼*d.* per lb.

Fat Lambs.—The season has been unfavourable for the fattening of lambs, the dams being mostly in low condition, and giving less milk than usual. The general average prices were 1*s.* 1*d.* for first, and 11¼*d.* for second quality. Prime lambs have fetched ½*d.* per lb. more than last year's April average. The low prices obtained in London compared with those of the country markets have again formed a striking feature of the trade.

Fat Pigs.—Bacon pigs have about maintained the advance attained in March, the averages in over thirty British markets being 6*s.* 9*d.* and 6*s.* 2*d.* per 14 lb. stone, which figures were about 6*d.* less than in April, 1911.

Carcass Beef—British.—Scotch short sides in London ranged from 4*s.* 10*d.* to 5*s.* 2*d.* per 8 lb. for prime, and 4*s.* 6*d.* to 4*s.* 10*d.* for second quality, and long sides from 4*s.* 6*d.* to 4*s.* 9*d.* and 4*s.* 4*d.* to 4*s.* 8*d.* The averages were 4*s.* 11*d.* and 4*s.* 8*d.* for short, and 4*s.* 7*d.* and 4*s.* 5*d.* for long sides, practically the same as in March, but with more fluctuation. English sides averaged 4*s.* 6*d.* and 4*s.* 4*d.* The last two weeks English sides realised as much as Scotch, a most unusual occurrence.

Port-Killed Beef.—Supplies were small and their value was quoted at the same as that of English. In the third week there was a dear market, and both descriptions touched 4*s.* 9*d.* per 8 lb.

Chilled Beef.—Argentine hindquarters averaged 3*s.* 5*d.* and 3*s.* 1*d.*, a slight advance on March prices. Forequarters again averaged 2*s.* 4*d.* and 2*s.* 2*d.*, the trade being relatively better than for hindquarters.

Frozen Beef.—The supplies of "hard beef" were very moderate, and this article was described as "scarce" in the London Central Market, prices showing some advance. New Zealand hindquarters averaged 2*s.* 9*d.* and 2*s.* 8*d.*, and fores 2*s.* 2*d.* and 2*s.* 1*d.* per stone. Australian and Argentine beef fetched 2*d.* and 1*d.* less respectively.

Carcass Mutton—Fresh-Killed.—There has been a very good trade for fresh-killed mutton till the last week, when there was a general depression in the market. Scotch averaged 5*s.* 5½*d.* and 5*s.* 2½*d.* per 8 lb., and English 5*s.* 0½*d.* and 4*s.* 9½*d.* These prices exceeded those of March by about ½*d.* per lb.

British Lamb.—There was much complaint in Smithfield Market of the poor demand for English lamb, but prices were considerably better than a year ago. Till the last week, when prices fell 1*d.* per lb., good lamb realised 1*s.* per lb. for prime and 11*d.* for second quality.

Frozen Mutton and Lamb.—There was practically no advance in the value of frozen mutton, and in view of the higher prices of fresh-killed and the somewhat smaller imports than last year, this fact has excited much remark. The best New Zealand averaged only 2*s.* 9½*d.* and 2*s.* 5*d.* per 8 lb., and Argentine and Australian about 5*d.* less. New Zealand lamb has sold fairly well at 3*s.* 8*d.* to 4*s.* 2*d.* per stone, and Australian at about 3*s.* 3*d.* to 3*s.* 6*d.*

Veal.—Trade in veal was quiet, and prices steady for English at 4*s.* 8*d.* to 5*s.* 4*d.* per 8 lb. for the first three weeks, but in the fourth there was a sudden drop of fully 1*d.* per lb.

Pork.—Supplies of pork were, on the whole, about normal, and the demand fairly steady, with prices declining as the month advanced, Engish averaging 4*s.* 5*d.* and 4*s.* and Dutch about 4*s.* 4*d.* and 3*s.* 11*d.* per 8 lb.

THE PROVISION TRADE IN APRIL.

HEDLEY STEVENS.

Bacon.—The advancing markets reported in last month's review have continued, and prices for all cuts of bacon and hams show considerable advances on those current in March. In many cases they amount to nearly 1*d.* per lb. Long sides have realised about 7*s.* per cwt. more money, and many American cuts show rises of from 7*s.* to 9*s.* per cwt.

The arrivals from the U.S.A. and Canada have fallen off considerably in quantities during the month, as even the high prices now prevailing in this country do not pay the packers a profit on the extreme figures which they are paying for the hogs. Advices from America forecast very high prices during the coming summer, and suggest 70*s.* and upwards for American-cut green hams. Hogs were still being marketed in smaller quantities at Chicago and other packing centres up to the end of the month, and prices ranged from $7.40 to $8.05, against $5.75 to $6.85 at the same time last year, and $8.85 to $10.70 two years ago.

There has been a fair trade passing throughout the month in all hog products, although it was not as brisk as many anticipated it would be after the labour troubles were settled.

English pigs continue to advance in price, and curers' immature lots are being marketed, showing that breeders continue to dispose of their stock, on account of the high cost of feed.

Cheese.—The consumptive demand has again been far from good, and by the end of the month the price of New Zealands had dropped about 4*s.* per cwt. since the end of March, and Canadians about 2*s.*

per cwt. This decline was totally unexpected, as stocks of old cheese are small, and it has, in fact, been thought that they are barely sufficient to last until the new make is available in any quantity. At the decline, prices for Canadians are about 8*s.* per cwt. above those current at the same time last season, and many dealers who are not carrying stocks are anxious to see lower prices now that the new season is beginning in Canada. Best Canadian fodder makes have been sold at 63*s.* c.i.f. for shipment to England on May 10th, which is several shillings above the price at the same time last year.

The conditions in Canada during April were reported as being favourable for a large early make of cheese, but with the shortage of stock from last season the home trade will require a fair proportion of the early makes.

The estimated stock of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month was 39,000 cheese, against 89,000 at the same time last year, and 114,000 two years ago.

With the favourable conditions existing in this country also during the month, the English make is expected to be fully up to the average, especially as the demand for milk for ordinary consumption has been less.

Butter.—It was confidently expected that the slow conditions of trade in this article as reported last month would come to an end when once the miners were back at work in the pits. The expectation, however, has not been realised, the demand during April having been even worse than in the previous month, and sweeping reductions in prices have taken place, resulting in very heavy losses to some importers, all of whom were of opinion that prices would again soon reach the high level that was prevailing before the coal strike. Some idea of the magnitude of the drop in values may be gained when one considers that the figure for finest New Zealand creameries was between 124*s.* and 128*s.* during the last week in March, as against 108*s.* and 112*s.* at the close of April.

It seems probable that we shall not see any substantial rise in prices now, as the home production will soon be largely in evidence, more especially as the demand for milk for ordinary consuming purposes has fallen off considerably. Irish butter is also being pushed for sale on the English markets. Meanwhile there are some who think that the market will stiffen again shortly, after the exceptionally dry month that April has proved in this country, as this is, of course, bound to have an effect on the pastures and decrease the flow of milk in the near future. The supplies of Colonial will also be much shorter from now until the season ends.

It is interesting to note that for the year ending April 30th, 1912, the total shipments from Canada amounted to 136,272 packages, against 27,921 during the previous twelve months, showing an increase of 108,351 packages.

Eggs.—There has been no special feature in this trade during the month. Prices are, on the whole, firmer, with smaller supplies. The demand has been fair and sufficient to prevent any accumulation of stock.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of April, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	ENGLAND.		SCOTLAND.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 4	8 8	42 1	38 6
Herefords	9 4	8 8	—	—
Shorthorns	9 2	8 4	41 2	37 8
Devons	9 3	8 3	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	9¼	8	9¼	7¼
Sheep:—				
Downs	9½	8¾	—	—
Longwools	8¾	7¾	—	—
Cheviots	10	9	9½	8¼
Blackfaced	9½	8½	8½	7½
Cross-breds	9½	8½	9¾	8½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	6 11	6 4	6 4	5 7
Porkers	7 3	6 9	6 10	6 1
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	21 6	17 17	22 17	18 5
,, —Calvers... ...	22 15	17 17	19 2	17 6
Other Breeds—In Milk ...	18 6	16 0	18 5	15 9
,, —Calvers ...	—	12 1	18 14	15 17
Calves for Rearing	2 5	1 14	3 3	2 4
Store Cattle:—				
Shorthorns—Yearlings ...	10 14	8 13	11 4	9 5
,, —Two-year-olds...	15 3	12 18	16 18	14 0
,, —Three-year-olds	18 10	16 3	18 17	16 2
Polled Scots—Two-year-olds	—	—	18 10	15 13
Herefords— ,,	16 18	14 14	—	—
Devons— ,,	15 4	13 5	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	43 8	36 3	—	—
Scotch Cross-breds ...	—	—	34 8	29 2
Store Pigs:—				
8 to 10 weeks old	16 1	12 8	18 0	13 0
12 to 16 weeks old	25 11	19 5	24 0	17 5

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of April, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—							
English	1st	63 6	61 0	63 0	60 6	60 0*	61 0*
	2nd	58 6	56 6	61 0	57 6	56 6*	58 6*
Cow and Bull ...	1st	54 6	49 6	50 6	50 6	53 0	52 0
	2nd	47 0	44 6	46 6	46 6	46 0	46 0
U.S.A. and Canadian :—							
Port Killed ...	1st	—	61 0	63 0	—	—	—
	2nd	—	56 6	61 0	—	—	—
Argentine Frozen—							
Hind Quarters...	1st	37 6	38 0	38 0	38 6	38 5	39 0
Fore ,, ...	1st	30 6	29 6	29 6	30 6	31 6	31 0
Argentine Chilled—							
Hind Quarters...	1st	47 0	48 0	47 6	47 0	48 6	49 0
Fore ,, ...	1st	32 6	32 0	33 0	32 0	34 0	35 6
Australian Frozen—							
Hind Quarters...	1st	36 0	35 0	36 6	35 0	—	36 6
Fore ,, ...	1st	31 6	28 6	29 0	29 0	—	30 0
VEAL :—							
British	1st	69 0	78 0	72 6	77 0	—	70 0
	2nd	60 6	72 6	63 0	71 6	—	—
Foreign	1st	—	—	72 6	—	72 6	70 0
MUTTON :—							
Scotch	1st	—	82 0	76 6	84 6	72 6	76 6
	2nd	—	77 6	73 0	80 0	65 6	66 6
English	1st	74 0	74 6	70 6	79 6	—	—
	2nd	63 6	69 0	67 0	73 0	—	—
Argentine Frozen ...	1st	35 0	35 0	33 0	35 6	34 6	34 6
Australian ,, ...	1st	34 0	32 6	32 0	33 0	—	33 0
New Zealand ,, ...	1st	36 0	—	39 6	—	—	37 6
LAMB :—							
British	1st	105 0	107 6	109 6	104 0	109 0	121 6
	2nd	97 0	95 0	100 6	95 0	84 0	112 0
New Zealand ...	1st	55 0	53 0	56 6	53 6	60 6	57 6
Australian	1st	48 6	48 0	48 6	48 6	—	50 6
Argentine	1st	48 0	48 0	—	48 6	46 6	50 0
PORK :—							
British	1st	62 6	60 0	62 6	63 6	55 0	58 0
	2nd	56 6	52 0	56 6	59 0	48 6	55 6
Foreign	1st	—	—	60 6	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6 ...	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
,, 13 ...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
,, 20 ..	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
,, 27 ...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3 ...	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
,, 10 ..	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
,, 17 ...	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
,, 24 ...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2 ...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
,, 9 ...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
,, 16 ..	32	6	30	1	34	0	23	6	24	11	31	2	18	0	17	6	21	8
,, 23 ..	32	9	30	2	34	1	23	7	25	0	31	10	17	11	17	5	21	9
,, 30 ...	33	0	30	3	34	4	23	8	24	11	30	3	18	0	17	5	21	8
Apl. 6 ...	33	6	30	4	34	10	23	1	24	7	30	9	17	11	17	7	21	11
,, 13 ...	33	7	30	3	35	4	23	5	25	2	30	2	18	3	18	3	22	1
,, 20 ...	33	7	30	4	36	7	23	0	25	5	29	11	18	3	17	10	22	4
,, 27 ...	33	0	30	11	37	10	22	10	25	5	30	4	18	3	18	3	22	9
May 4 ...	32	6	31	4	38	1	22	7	25	7	30	2	18	2	18	6	23	1
,, 11 ...	32	1	31	8			22	0	25	1			18	1	19	0		
,, 18 ...	31	10	32	6			21	8	25	4			17	8	19	2		
,, 25 ...	31	3	32	8			21	4	25	0			17	10	19	5		
June 1 ...	30	2	32	5			21	8	24	10			17	10	19	5		
,, 8 ...	29	1	32	4			20	9	25	7			17	10	19	7		
,, 15 ...	29	0	32	3			18	11	23	11			18	0	19	8		
,, 22 ...	29	4	31	11			20	1	23	9			17	9	19	10		
,, 29 ...	29	9	31	10			19	11	24	5			17	7	19	9		
July 6 ...	30	4	32	1			19	5	25	10			17	4	19	9		
,, 13 ...	31	1	32	3			21	3	25	10			17	7	19	11		
,, 20 ...	31	11	32	5			19	9	24	3			17	5	19	5		
,, 27 ...	33	5	32	5			20	10	23	8			18	1	19	7		
Aug. 3 ..	33	9	32	0			20	5	24	4			18	3	18	2		
,, 10 ...	33	5	31	6			20	4	26	9			18	0	18	0		
,, 17 ...	32	11	31	6			20	11	27	8			17	11	17	10		
,, 24 ...	32	7	31	8			20	10	28	10			17	2	18	0		
,, 31 ...	32	2	31	7			22	10	28	4			17	2	18	3		
Sept. 7 ...	31	11	31	10			23	3	28	4			17	2	18	1		
,, 14 ...	30	11	32	0			24	3	29	0			16	6	18	5		
,, 21 ...	30	2	32	4			24	2	29	11			16	3	18	9		
,, 28 ...	30	1	32	6			24	4	30	5			16	4	19	1		
Oct. 5 ...	30	1	32	7			24	7	30	9			16	3	19	5		
,, 12 ...	30	2	32	9			25	1	31	0			16	2	19	10		
,, 19 ...	30	4	32	9			25	3	31	5			16	1	19	11		
,, 26 ...	30	4	33	1			25	4	31	7			16	2	20	6		
Nov. 2 ...	30	4	33	4			25	6	31	10			16	2	20	8		
,, 9 ...	29	11	33	4			25	4	32	7			15	11	20	11		
,, 16 ...	29	8	33	1			25	1	32	10			16	1	21	0		
,, 23 ...	29	11	33	0			24	10	33	5			16	4	20	10		
,, 30 ...	30	6	32	10			24	7	33	10			16	7	20	11		
Dec. 7 ...	30	9	32	9			24	3	34	0			16	9	20	9		
,, 14 ...	30	7	32	11			23	9	33	5			16	10	20	9		
,, 21 ...	30	7	32	9			23	10	33	5			16	9	20	8		
,, 28 ...	30	5	33	0			23	9	33	4			16	9	20	7		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.				BARLEY.				OATS.			
		1911.		1912.		1911.		1912.		1911.		1912.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d*
France:	March	46	5	46	7	26	8	29	8	21	11	23	5
	April	45	11	49	7	26	6	30	2	21	11	24	0
Paris:	March	47	0	48	6	24	8	29	0	22	8	24	6
	April	46	1	52	2	24	8	29	5	23	4	25	8
Belgium:	February	32	4	35	2	24	1	30	3	19	2	24	6
	March	32	5	35	3	24	7	30	7	19	8	24	11
Germany:	February	40	9	45	1	28	4	36	7	21	9	27	9
	March	40	6	44	6	29	0	35	10	22	3	27	8
Berlin:	February	42	7	45	6	—		—		21	4	27	9
	March	42	6	45	5	—		—		21	8	27	8
Breslau:	February	38	1	40	4	27 22	7* 11†	32 28	10* 6†	19	10	25	11
	March	37	10	40	4	27 22	7* 11†	32 28	10* 11†	20	1	25	7

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of April, 1911 and 1912.

—	WHEAT.				BARLEY.				OATS.			
	1911.		1912.		1911.		1912.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
London	31	9	37	0	24	1	32	11	18	9	23	8
Norwich	30	6	35	7	24	11	30	3	17	9	22	1
Peterborough	29	11	36	4	24	10	29	7	17	7	22	8
Lincoln	29	11	36	3	25	9	2	11	17	10	22	4
Doncaster	29	9	34	4	24	10	28	7	17	6	21	8
Salisbury	30	1	36	2	23	9	31	2	17	1	22	4

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of April, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb	per 12 lb.
British ...	15 3	14 3	—	—	14 6	13 3	15 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	123 6	120 6	119 0	116 0	119 0	117 0	117 0	112 0
,, Factory ...	117 0	110 0	114 0	108 6	—	—	—	—
Danish ..	—	—	129 6	127 0	128 6	126 0	126 0	—
French ...	—	—	—	—	143 6	140 0	—	—
Russian ...	124 0	120 6	113 0	111 0	118 0	114 6	—	—
Australian ...	122 6	118 0	118 6	115 0	118 6	115 6	118 6	106 0
New Zealand	124 6	120 0	120 6	118 6	121 6	117 6	120 6	—
Argentine ...	119 0	117 0	116 6	114 6	117 0	114 0	120 0	—
CHEESE :—								
British—								
Cheddar ...	96 0	84 0	90 0	86 0	89 6	83 6	64 6	64 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	73 0	68 0	78 6	70 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt		
Canadian ...	76 6	75 6	76 6	74 6	77 0	76 0	76 0	—
BACON :—								
Irish	68 0	62 6	68 6	63 0	70 0	65 0	65 0	—
Canadian ...	62 0	60 0	61 6	59 6	62 0	59 6	62 6	60 6
HAMS :—								
Cumberland ..	—	—	—	—	102 6	93 6	—	—
Irish	—	—	—	—	97 0	90 0	98 6	96 6
American (long cut)	60 6	57 6	60 6	58 0	62 6	59 6	62 0	58 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	8 9	7 11	—	—	9 4	8 6	—	—
Irish	8 4	8 1	8 7	8 1	9 5	8 7	8 6	8 0
Danish ...	—	—	—	—	9 6	8 6	9 7	8 7
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
Edward VII.	95 0	85 0	71 6	66 6	87 6	77 6	—	—
Langworthy ...	93 6	83 6	85 0	80 0	95 0	86 0	60 0	55 0
Up-to-Date ...	88 0	76 6	71 6	66 6	83 6	73 6	53 6	48 6
HAY :—								
Clover ...	115 0	105 0	122 0	104 6	122 0	106 0	98 6	93 6
Meadow ...	110 0	100 0	—	—	116 6	94 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	APRIL.		FOUR MONTHS ENDED APRIL.	
	1912	1911.	1912.	1911.
Anthrax:—				
Outbreaks	69	81	394	342
Animals attacked	88	97	444	398
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	18
Glanders (including Farcy):—				
Outbreaks	10	19	57	71
Animals attacked	29	30	134	214
Parasitic Mange:—				
Outbreaks	244	—	1,760	—
Animals attacked	430	—	3,985	—
Sheep-Scab:—				
Outbreaks	6	12	149	292
Swine-Fever:—				
Outbreaks	316	242	1,106	755
Swine Slaughtered as diseased or exposed to infection ...	4,217	2,238	14,025	7,969

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	APRIL.		FOUR MONTHS ENDED APRIL.	
	1912.	1911.	1912.	1911.
Anthrax:—				
Outbreaks	—	—	1	3
Animals attacked	—	—	1	3
Glanders (including Farcy):—				
Outbreaks	—	—	—	1
Animals attacked	—	1	—	2
Parasitic Mange:—				
Outbreaks	4	4	31	37
Sheep-Scab:—				
Outbreaks	33	22	241	224
Swine-Fever:—				
Outbreaks	35	10	87	45
Swine Slaughtered as diseased or exposed to infection ...	299	133	712	799

SELECTED CONTENTS OF PERIODICALS.

Horticulture—

Pollination of Hardy Fruits, *C. H. Hooper.* (Jour. Roy. Hort. Soc., Vol. XXXVII., Part III., March, 1912.) [63.41(04).]

Der Kohlbau in Holland, *Dr. J. Frost.* (Mitt. Deut. Landw. Gesell., 10 Februar, 1912.) [63.511; 63.5(492).]

Plant Diseases—

Streak Disease (*Thielavia basicola*) of Sweet Peas, *F. J. Chittenden.* (Jour. Roy. Hort. Soc., Vol. XXXVII., Part III., March, 1912.) [63.24.]

Investigations on Potato Diseases, Third Report, *G. H. Pethybridge.* (Dept. Agr. and Tech. Instr. Ireland Jour., Vol. XII., No. 2, January, 1912.) [63.24-33.]

Contribution à l'étude de la maladie du "Pied noir des céréales" ou "Maladie du Piétin," *G. Fron.* (Ann. Sci. Agron., Janvier, 1912.) [63.24-31.]

Beiträge zur Kenntnis der Roncetkrankheit oder Krautern der Rebe, *E. Pantanelli.* (Ztschr. Pflanzenkrank., XXI. Band, Heft 1, 1912.) [63.24-46.]

Zur Ausbreitungsgeschichte des amerikanischen Stachelbeermehltaus (*Sphaerotheca mors uvae*) in Baden und einige Bemerkungen über den Eichenblattmehltau, *Dr. Karl Müller.* (Ztschr. Pflanzenkrank., XXI. Band, Heft 8, 1911.) [63.24.]

Beiträge zur Kenntnis der Kartoffelpflanze und ihrer Krankheiten. III. Zur Kenntnis der Bakterienfäule der Kartoffel, *Dr. Julius Schuster.* (Arb. K. Biol. Anst. Land. u. Forstw., VIII. Band, Heft 4, 1912.) [63.23.]

Live Stock—

Über den Einfluss der Ernährung und der Haltung auf die Gewichtszunahme, die Ausbildung der Körperformen und das Schlachtergebnis beim wachsenden Schwein. Fütterungsversuche mit Trockenhefe, Kartoffeln und Gerste, *Wilhelm Völtz.* (Landw. Jahr., XLII. Band, Heft 1, 1912.) [612.394; 63.64.]

The Rôle of Different Proteins in Nutrition and Growth. (Science, November 24, 1911.) [612.304.]

Dairying and Food, General—

Contributions to the Chemistry of Cheddar Cheese, *M. Nierenstein.* (Jour. Agr. Sci., Vol. IV., Part 3, January, 1912.) [54(04); 63.736.]

Les expériences danoises concernant la valeur des tourteaux de soja pour l'alimentation des vaches laitières et l'influence qu'ils exercent sur la qualité du beurre, *A. Mallèvre.* (Ann. Sci. Agron., Février, 1912.) [63.711.]

Forestry—

Die Standortsuntersuchung beim forstlichen Versuchswesen, *Leistner.* (Allg. Forst u. Jagd Ztg., Februar, 1912.) [63.49(04).]

Die natürliche Verjüngung der Nadelhölzer in Thüringen nebst einigen Bemerkungen über diese Form der Bestandesbegründung, *U. Menzel.* (Allg. Forst u. Jagd. Ztg., März, 1912.) [63.492; 63.49(04).]

Engineering—

Irrigation in South Africa, *W. A. Legg.* (Jour. Roy. Soc. Arts, February 9, 1912.) [63.13.]

Economics—

The Tendency towards Uniformity in Compensation for Agricultural Improvements, *Leslie S. Wood.* (Trans. Surv. Inst., Vol. XLIV., Part VII., 1912.) [347(a).]

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Keatinge, G.—Rural Economy in the Bombay Deccan. (212 pp.) London: Longmans, Green & Co., 1912. 4*s.* 6*d.* net. [63(54).]

Ireland, Dept. of Agriculture and Technical Instruction.—Farmer's Account Book. Prescribed by the Dept. for use in connection with Winter Agricultural Classes. London: Wyman & Sons, 1909. 1*s.* [657.]

Memoirs of the Geological Survey, England and Wales.—The Geology of the Country around Ollerton. (93 pp.) London: E. Stanford, 1911. 2*s.* [55 : 912.]

Hopkins, C. G.—The Story of the Soil: From the Basis of Absolute Science and Real Life. (350 pp.) London: T. Werner Laurie, n.d. 6*s.* net. [63(73); 63(022).]

U.S. Dept. of Agriculture, Office of Experiment Stations.—Bull. 247:—Organisation Lists of the Agricultural Colleges and Experiment Stations in the United States. (103 pp.) Washington, 1912. [37(73).]

South Australia, Dept. of Agriculture.—Bull. 65:—Roseworthy Agricultural College; Fourth Report on the Permanent Experiment Field, Seasons 1909–10 and 1910–11. (54 pp.) Bull. 66:—Agricultural Bureau Congress, 1911. (72 pp.) [63(063).] Adelaide, 1911.

*Rural Education Conference.**—Fifth Report:—Courses in Agricultural Colleges. [Cd. 6151.] (31 pp.) London: Wyman & Sons, 1912. 3*d.* [37(42); 378.]

East Suffolk County Education Committee.—Circ. 101, 1911:—Suggestions as to Suitable Manures for the Common Farm Crops, together with a few notes on Farmyard Manure. (12 pp.) Ipswich, 1911. [63.163; 63.16.]

Pennsylvania Agricultural Experiment Station.—Bull. 113:—Work of the Agricultural Experiment Station for 1910–11. (22 pp.) Centre County, Pennsylvania, 1912.

*Board of Education.**—Report of the Advisory Committee on the Distribution of Exchequer Grants to Universities and University Colleges in England. [Cd. 6140.] (9 pp.) London: Wyman & Sons, 1912. 1½*d.* [378.]

Missouri Agricultural Experiment Station.—Circ. 54:—Co-operative Experiments of the Department of Agronomy. (151–161 pp.) Columbia, Missouri, 1912. [63.3.]

Wisconsin Agricultural Experiment Station.—Bull. 216:—The Use of Explosives in Clearing Land. (19 pp.) [63.12.] Bull. 218:—Report of the Director, 1911. (78 pp.) Madison, Wisconsin, 1911.

Field Crops—

Bangor, University College of North Wales.—Bull. VI., 1911:—Manuring of Potatoes. (4 pp.) [63.512–16.] Bull. VII., 1911:—Manuring of Mangels and Swedes. (5 pp.) [63.332.] Bangor, 1912.

India, Agricultural Research Institute, Pusa.—Bull. 27:—Experiments on the Cultivation of Sugar-Cane at the Partabgarh Experimental Station, 1909–11. (29 pp.) Calcutta, 1912. 6*d.* [63.3431.]

Horticulture—

Gordon, G.—Poppies. [One and All Garden Books, No. 38.] (20 pp.) London: Agricultural and Horticultural Association, n.d. 1*d.* [63.52.]

Fritsch, J.—Emploi des Engrais Chimiques en Horticulture. (178 pp.) Paris: Lucien Laveur, 1912. 3*s.* 9*d.* [63.5(02); 63.16.]

South Australia, Dept. of Agriculture.—Bull. 68:—The Currant Industry; Wire-Netting Racks for Drying. (12 pp.) Adelaide, 1912. [63.41(*c*); 664.85.]

Plant Diseases—

Bally, W.—Cytologische Studien an Chytridineen. (95–156 pp.) [Jahrbücher für wissenschaftliche Botanik, 50 Band, 2 Heft, 1911.] [63.24(04).]

Smith, E. F.—Bacteria in Relation to Plant Diseases, Vol. II. (368 pp. + 20 plates.) Washington, 1911. [63.23.]

U.S. Dept. of Agriculture, Bureau of Plant Industry.—Circ. 91:—The Nematode Gallworm (*Heterodera radicicola*) on Potatoes and Other Crop Plants in Nevada. (15 pp.) Washington, 1912. [63.27.]

U.S. Dept. of Agriculture, Bureau of Entomology.—Bull. 101:—Calosoma Sycophanta: Its Life History, Behaviour, and Successful Colonisation in New England. (94 pp. + ix. plates.) Washington, 1911. [63.296.] [This insect is one of the most important of the natural enemies of the gipsy moth and the brown-tail moth.]

South Australia, Dept. of Agriculture.—Bull. 64:—Peach Leaf Curl Fungus (*Exoascus deformans*, Fuckel). (10 pp.) [63.24.] Bull. 67:—Codlin Moth Control; Further Tests with Lead Arsenates. (11 pp.) [63.27.] Adelaide, 1911.

Cuba, Secretaria de Agricultura, Comercio y Trabajo.—Bol. 20:—Insectos y Enfermedades de la Yuca en Cuba. (28 pp. + viii. plates.) Habana, 1911. [63.24–33; 63.27–33.]

Missouri Agricultural Experiment Station.—Bull. 98:—The San José Scale in Missouri. (61–116 pp.) Columbia, Missouri, 1912. [63.27.]

Live Stock—

Canada, Dept. of Agriculture.—The Sheep Industry in Canada, Great Britain, and United States. Report of the Commissioners. (187 pp.) Ottawa, 1911. [63.63.]

Vacher, Marcel.—Le Bétail: Reproduction, Amélioration. (84 pp.) Paris: Bibliothèque Larousse. 1.15 fr. [575.4; 63.603.]

Dairying and Food, General—

Sadler, W.—Bacteria as Friends and Foes of the Dairy Farmer. (112 pp.) London: Methuen and Co., 1912. [576.8.]

Osborne, T. B., and *Mendel, L. B.*—Feeding Experiments with Isolated Food-Substances, Parts I. and II. (138 pp. + 2 plates.) [Carnegie Institution of Washington, Publication No. 156.] Washington, 1911. [612.394.]

Sheldon, J. P.—Dairying: A Book for all who are Engaged in the Production and Management of Milk. (465 pp.) London: Cassell & Co., 1912. 7*s.* 6*d.* net. [63.70(02).]

*Local Government Board, Reports on Public Health and Medical Subjects.**—New Series, No. 63:—Report upon the available data in regard to the value of boiled milk as a food for infants and young animals. (60 pp.) London: Wyman & Sons, 1912. 9*d.* [612; 63.71.]

Kansas Agricultural Experiment Station.—Circ. 21:—Better Butter for Kansas; A Circular Explaining the Relation between the Quality of Butter and Prices Paid for Butter Fat. (4 pp.) Manhattan, n.d. [63.726.]

Veterinary Science—

Reynolds, M. H.—Veterinary Studies for Agricultural Students. (290 pp.) New York: The Macmillan Co., 1910. 7*s.* 6*d.* net. [619(02).]

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Circ. 191:—Various Methods for the Diagnosis of Glanders. (345–370 pp. + 4 plates.) [619.1(*a*).] Circ. 193:—Our Present Knowledge of the Distribution and Importance of Some Parasitic Diseases of Sheep and Cattle in the United States. (419–463 pp. + 2 plates.) [59.169.] Washington, 1912.

Birds, Poultry, and Bees—

Hurst, J. W.—Egg-Production. (120 pp.) London: G. Newnes, n.d. 1*s*. net. [63.651 ; 63.74.]

Forestry—

United States House of Representatives, Sixty-second Congress, First Session.—Document No. 9:—Report on Preliminary Examination of Merrimac River, Mass., from Haverhill to Lowell, together with a Report on an Investigation of the Influence of Forests on the Run-off in the Merrimac River Basin. (123 pp. + 25 charts.) Washington, 1911. [63.49(73).]

Ireland, Dept. of Agriculture and Technical Instruction.—Forestry Notes: Being Practical Hints on the Formation, Management, and Protection of Woodlands in Ireland. (69 pp. and plates.) London: Wyman & Sons, 1911. 9*d*. [63.49–19 ; 63.49(415).]

Rousset, A.—Le Jardinage Forestier; Méthode Naturelle d'Aménagement des Forêts en Futaie. (52 pp.) Paris: Lucien Laveur, 1911. 1 fr. [63.49–19.]

*Departmental Committee on Forestry in Scotland.**—Report, Appendices, and Minutes of Evidence. [Cd. 6085.] (95 pp.) London: Wyman & Sons, 1912. 1*s*. 3*d*. [63.49(41).]

Kubelka, A.—Die intensive Bewirtschaftung der Hochgebirgsforste. (86 pp.) Wien: Wilhelm Frick, 1912. [63.49–19.]

California Agricultural Experiment Station.—Bull. 225:—Tolerance of Eucalyptus for Alkali. (247–317 pp.) Sacramento, 1911. [63.493.]

Missouri Agricultural Experiment Station.—Circ. 51:—How to Prolong the Life of Fence Posts. (135–138 pp.) [63.49–198.] Circ. 52: Growing a Woodlot from Seed. (139–146 pp.) [63.49–19.] Columbia, Missouri, 1912.

India.—Forest Bull. 8:—A Note on some Germination Tests with Sal Seed (*Shorea Robusta*). (13 pp.) 3*d*. [63.493.] Forest Bull. 9:—Note on the Resin-Value of *Podophyllum Emodi* and the Best Season for Collecting it. (5 pp.) 2*d*. [63.49–197.] Calcutta, 1912.

Engineering—

Taylor, F. Noël.—Small Water Supplies: Being a Practical treatise on the methods of collecting, storing, and conveying water for domestic use in large country mansions, estates, and small villages and farms. (174 pp.) London: B. T. Batsford, 1911. 6*s*. net. [628.7.]

Shaw, W. N.—Forecasting Weather. (380 pp. with Maps, Charts, and Diagrams.) London: Constable & Co., 1911. 12*s*. 6*d*. net. [551.5.]

Economics—

Saskatchewan, Dept. of Agriculture.—Bull. 29:—Final Report on Grain Crops and Live Stock of the Province of Saskatchewan for 1911. (30 pp.) Regina, Saskatchewan, 1912. [31(71).]

Spain, Instituto Agricola Catalán de San Isidro.—Constitución Familiar y Organización de la Propiedad Rural en Cataluña. (20 pp.) Barcelona, 1912. [325.3 ; 333.5.]

Pratt, E. A.—Traders, Farmers, and Agricultural Organisation—An Inquiry into an Alleged Conflict of Interests. (31 pp.) London: P. S. King & Son, 1912. 3*d*. net. [338.1 ; 334(04).]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P5. 37 & 45. 6,000. 5/12. R. C. & S., Ltd.

THE JOURNAL

OF THE

BOARD OF AGRICULTURE

Vol. XIX. No. 3.

JUNE, 1912.

YELLOW DISCOLORATION OF STILTON CHEESE.

JOHN GOLDING, F.I.C., F.C.S.

Midland Agricultural and Dairy College.

It is a most difficult and uncertain operation to make a Stilton cheese which, when ripe, will be pronounced as of first-class quality. Even the best makers are forced to rely to a large extent on a process of selection of the finished product, and a very considerable wastage occurs. The ripe cheese should be soft and creamy in texture, the colour should be white and evenly veined with blue mould, and the flavour and aroma unique and of a high standard of excellence; moreover, it is necessary that the cheese should ripen uniformly, within from three to six months of making, but that it should not quickly become too ripe or decompose.

Very little is known of the scientific principles involved in the production of this excellent cheese, and in districts where it is most successfully made even the best makers accept a certain percentage of failures with resignation. In these dairies, one of the most frequent sources of loss when the cheeses reach maturity is a yellow discoloration, which begins to appear in patches or spots at the stage in the ripening process when a good cheese should begin to show blue veins. These yellow spots are most usually found near the ends or in any crack where the blue mould (*Penicillium glaucum*) would be likely to grow. Sometimes the conditions seem to be so nearly balanced that it is uncertain if the cheese will turn yellow or blue. If there is a fault in the coat, or if the cheese has been struck by fly (*Piophila casei*), the yellow colour is most likely to be seen first in these places, where air can gain access to the cheese.

As the cheese ripens the yellow colour spreads (see Fig. 1), and the cheese becomes soft and pasty, but seldom blue, in the affected parts. It has been observed in the course of the experiments described below, that in older cheeses, especially if the cheese is cut, the yellow colour becomes red and even black. The keeping qualities of cheeses affected in this way are greatly deteriorated.

There is no evidence that this abnormal condition is in any way injurious to health; but the market value of the product is considerably lower than in the case of sound cheeses. Buyers are always on the look out for these yellow spots, and just as the price rises in the case of a nice blue cheese, so it is lowered when the "iron" discloses yellow spots.

In thirty dairies visited last year, the loss directly due to yellow discoloration amounted to several hundred pounds. The trouble is very variable in extent, and is almost unknown or slight in some dairies, while it may be very prevalent in others. In the great majority of dairies visited, it was looked upon as a most serious source of loss to the industry, and one which was urgently in need of scientific investigation.

Many suggestions were made by practical cheese-makers as to the cause of the trouble, and included the following:—(1) Too little salt; (2) too much whey, that is, putting the curd into the hoop in too moist a condition; (3) lack of acidity at various stages of making.

A grant having been made from the Development Fund by the Board of Agriculture and Fisheries, a systematic investigation was started by the writer, at the Midland Agricultural and Dairy College, in July, 1911.

With a view to investigating more closely the practical side of the problem, a small laboratory was fitted up in the dairy of a large Stilton cheese-maker in the Melton Mowbray district, where the trouble was prevalent. Here twenty-four cheeses were made under controlled conditions, the usual method of making as practised in this dairy being adopted. The time required for the various operations, the acidity at various stages, the weight of the curd for each cheese, the weight of salt, and the percentage of moisture in the curd were noted. Chemical and bacteriological examinations of the milk supplied to the dairy were also made. The milk proved to be rich in fat (about 4 per cent.), and the number of bacteria contained in it was as a rule comparatively low.

The chief peculiarity of the method of making at this dairy was that the curd was "put up" in a very soft state; at the time of putting into the hoops it contained on an average 62 per cent. of water. About 11 oz. of salt were used to 28 lb. of curd.

The most striking results were obtained from some experiments in which the quantity of salt was varied. Three cheeses were made from the same vat of curd with 5, 10, and 15 oz. of salt respectively. The result was quite contrary to what was expected from the accepted idea in the locality; for the cheese which contained 15 oz. of salt went most yellow, that with 10 oz. next, also rather yellow, while the cheese with 5 oz. could not be made to go yellow (see below). The experiment was repeated, and the result confirmed. The conclusion that too much salt tends to produce the yellow discoloration was also supported, unfortunately on a very large scale, by a cheese-maker in another locality, who, in his endeavours "to cure his cheese thoroughly," had used 13 oz. of salt to each cheese, and had a quarter of his make spoilt by yellow discoloration.

At the Midland Agricultural and Dairy College, Kingston, where 7 oz. of salt are used to 28 lb. of curd, the yellow discoloration was unknown. Here also twenty-six cheeses were made under close observation as at the Leicestershire dairy, many of them being made in the same way as regards moulding the curd in a wet condition. These cheeses showed very little sign of yellowing, and none were yellow at the earlier stages of ripening with the exception of one small experimental cheese, which was made with 7 oz. of salt to 14 lb. of curd. This cheese afterwards went black, while a control cheese made with 2 oz. of salt did not show any signs of yellow discoloration till the cheese with 7 oz. was black.

This result, however, was not confirmed in the case of two other small cheeses which were made with similar quantities of salt; these cheeses were very hard, and both became blue by May, but showed no signs of yellow discoloration—a result which indicates that salt is not the only factor to be considered in the yellow discoloration of Stilton cheese.

Before leaving the more practical side of the problem, it will be well to consider the proportion of yellow cheeses, as estimated by the makers themselves, in twenty-one of the dairies visited. A list of such cheeses (see below) was made out with special reference to the kind of rennet used; but in some cases information as to the quantity of salt used was volunteered. In this connection it is noticeable that of the three dairies where the discoloration was unknown, two used only 7 oz. of salt to 28 lb. of curd, while in the third the quantity used was not stated.

Dairy No.	County.	Village.	Yellow Cheeses. Season, 1911.	Kind of Rennet used.	Notes.
1	Leicestershire	a.	Very few	Commercial	—
2	,,	b.	7 per cent.	Home made	11 oz. salt to 29 lb. curd
3	,,	c.	17 ,,	,,	11 oz. salt to 29 lb. curd
4	,,	d.	5 ,,	,,	11 oz. salt to 29 lb. curd
5	,,	e.	6 ,,	,,	11 oz. salt to 29 lb. curd
6	,,	f.	10 ,,	,,	11 oz. salt to 29 lb. curd
7	,,	g.	None	Commercial	—
8	,,	g.	5 per cent.	Home made	—
9	,,	g.	Only a few	,,	—
10	,,	g.	11 cheeses, several brown	,,	13 oz. salt to 29 lb. curd
11	,,	h.	A few	,,	—
12	,,	h.	"Some yellow"	,,	—
13	,,	h.	3 per cent.	Commercial	Small cheeses
14	,,	k.	6 cheeses	Home made	7 oz. salt to 26 lb. curd
15	,,	k.	None	,,	7 oz. salt to 28 lb. curd
16	,,	l.	A few	,,	—
17	,,	l.	A few dozen	,,	Out of June make
18	,,	m.	Many	Commercial	Hot ripening room
19	Notts.	m.	Few	Home made	—
20	Derbyshire	o.	25 per cent.	Commercial	13 oz. salt
21	Notts.	p.	None	Commercial	7 oz. salt to 28 lb. curd

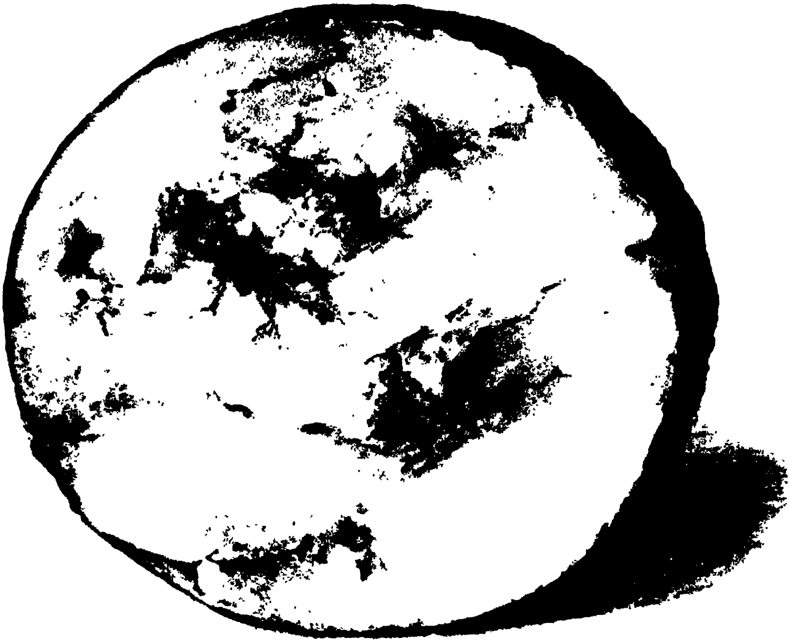


Fig 1. DISCOLOURED STILTON CHEESE

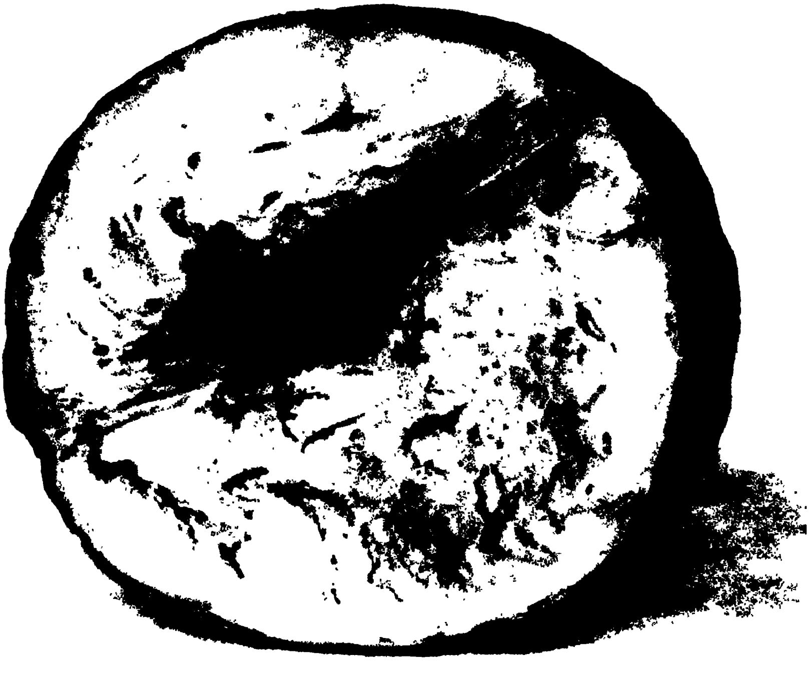


Fig. 2. COLOUR PRODUCED BY TYROSINE.

In other dairies where more salt was used, the yellow discoloration was more marked, reaching its maximum with the largest quantity of salt, viz., 13 oz. per cheese.

It will be seen from the table that in fifteen out of the twenty-one dairies home-made rennet is still used. There is a prevalent idea that commercial rennets make hard cheeses, but this view is not held by most users of the best commercial rennets. Before any two samples of rennet are compared, it is absolutely necessary that a rennet test should be made, and equal strengths of rennet used for making two vats of cheese side by side. The commercial rennets are much stronger than the home-made ones, and are probably used in excessive quantities when they are first tried. In a recent experiment 2½ oz. of a commercial rennet were found to be equal in coagulating effect to 10 oz. of home-made rennet.

Rennets contain two kinds of ferments, organised ferments or bacteria, and unorganised ferments or enzymes; the former are present in greater numbers and variety in the home-made rennets, and constitute a source of danger. Two kinds of enzymes are generally recognised: one which coagulates the milk, the other which produces further changes during the ripening of the cheese.

It was at first thought that the discoloration of the cheeses might be of a simple bacteriological nature. A large number of samples of yellow and sound cheeses were therefore obtained, and plate cultures were made from these, as well as from the milks used for making the cheeses and from the rennets. The examination of these cultures led to the following conclusions:—

(1) That there was no one organism present on the plates made from the yellow cheeses which was absent from the plates made from the sound cheeses.

(2) Organisms of various kinds which produced yellow colours on gelatine were almost always present on the plates; but neither the plates, nor microscopical examinations of the yellow parts of the cheeses, indicated the presence of any specific organism in the yellow parts.

Over 100 pure cultures were made and examined; but as it was not possible to test these by inoculation into whole cheeses, a selected number were tested by the inoculation of cores which were bored from specially made Stiltons, and reintroduced into the cheeses after inoculation. As the cheeses ripened these infected parts were bored and examined, but with one exception gave negative results. The exception was a culture, which showed some signs of having produced yellowing at a late stage of ripening.

Another positive result was obtained with a cheese made at Kingston, the curd of which, after being turned out on the drainer in the process of making, had been inoculated with the broken parts of a Stilton cheese made in a dairy in Leicestershire, where the trouble was prevalent. This cheese, made on September 29th with 3 oz. of salt to 15 lb. of curd, showed a yellow colour on February 15th, and when cut up on May 2nd showed considerable yellow and pink coloration, while even at this stage of ripening the control cheese showed very little sign of yellow discoloration.

Other experiments in which sound cheeses made at Kingston were inoculated with pure cultures of organisms from yellow cheeses, and in which cores of sound cheeses were inoculated with parts of yellow cheeses, gave negative results.

A study of these results suggested that this was not a simple bacteriological problem.

Quantitative determinations of the number of organisms in the sound and the yellow portions taken from the same cheese showed, as a rule, that the number of organisms in the yellow parts greatly exceeded the number in the sound parts, and also that in the sound parts there were more mould colonies.

The preparation of samples from the sound and the yellow parts of the cheeses for chemical analysis, indicated very clearly the nature of the chemical changes which were taking place in the yellow parts. It was found necessary, on account of the large percentage of fat in the cheeses, to extract the bulk of this ingredient with ether before fair samples could be obtained. This process incidentally stopped the action of all forms of organised ferments; but as the ether evaporated the action of the enzymes continued, a greater amount of air at the same time being admitted to the residue of the cheese. It was very noticeable that while the sound parts of the cheese remained white, the yellow portions became much darker. Yellow samples of cheese exposed to air, even without extraction of the fat, became much darker, and even passed to red and afterwards to black.

A soft old cheese, which had been sent to the laboratory early in the season was, on being cut open, found to be yellow and rotten on the outside and for about an inch deep all round, while the interior, which was protected from the air, was of a grey-green colour. This central part was extracted in the absence of air, first with alcohol, then with ether, and finally with water. The extracted residue was of a light grey colour, but on exposure to the air it turned black, while a part unexposed to the air remained of a light colour.

Observations of this kind, together with experiments on the cheese in test-tubes and petrie dishes, clearly showed that these colour changes were due to the action of the oxygen of the air. The fact that the colour changes did not take place in cheese which had been heated, but that they did occur in cheese which had been treated with chloroform or ether, showed also that the action was due to an unorganised ferment or enzyme, and not directly to bacterial action or to simple chemical changes. The type of ferment which brings about such changes is called an oxydase. Attempts to isolate this oxydase from the cheese or rennet have so far been unsuccessful; but its presence was demonstrated in the cheese, and its action appeared to be hastened by the presence of ferrous sulphate.

A consideration of the oxydases which occur in nature and which are known to be widely distributed and to produce similar colours, led to the suggestion that tyrosinase was the cause of the trouble. Tyrosinase is an oxydase which acts on tyrosine and certain other products formed by the breaking down of the casein of the cheese, with the production of coloured bodies known as melanins. It has a very specific action on tyrosine, producing red and black colours.

With a view to finding out if this enzyme was present and able to act under the conditions obtaining in a normal Stilton cheese, two good sound cheeses were selected; one of these cheeses was made in Leicestershire on August 1st with 11 oz. of salt and home-made rennet, while the other was made at Kingston with 7 oz. of salt and commercial rennet. On February 22nd the two cheeses were tested and found to be free from any trace of discoloration, both being "blue."

Three holes were bored in the top of each cheese, and the following injections were made:—

(1) 5 c.c. of water in one hole in each cheese.

(2) 5 c.c. of a 1 per cent. solution of ferrous sulphate in each cheese.

(3) 5 c.c. of a 0·1 per cent. solution of tyrosine in each cheese.

On February 29th borings showed that colours were developing under the place where the tyrosine had been injected; but not under the places where the water or ferrous sulphate had been added. On March 14th (after twenty-two days), the cheeses were cut up. Fig. 2 shows the colours produced under the boring of the Leicestershire cheese where the tyrosine had been introduced; these colours were well marked in every section under the tyrosine injection, but were absent under the places where the water and ferrous sulphate had been added. The result was confirmed in the case of the Kingston cheese, though to a much less extent.

On April 18th further experiments of the same kind were tried, four cheeses being taken and treated with 10 c.c. of a 0·1 per cent. solution of tyrosine. These cheeses were cut up on May 2nd, with the following results:—

(1) A cheese made in Leicestershire with 5 oz. of salt to 28 lb. of curd, home-made rennet being used. This cheese showed no sign of discoloration.

(2) A cheese made at Kingston, with 6 oz. of salt to 27 lb. of curd. Here considerable blackening had taken place just where the tyrosine solution had collected, but not to so marked an extent as in the cheese with higher salt content used in the previous experiments (see p. 183).

(3) and (4) These were two rather acid cheeses, made at Kingston, with 7 oz. of salt, and in these cases no discoloration was observed.

These experiments indicate that in some cases the presence of tyrosine is the limiting factor in the production of discoloration.

A. W. Dox states* that many species of bacteria destroy the tyrosine formed in cheese; but that salt is known to reduce the growth of organisms of this type. He found such an accumulation of tyrosine in Roquefort cheese containing 4 per cent. of salt that the substance had formed crystals, which he was able to pick out and identify. This offers a possible explanation of the action of salt in favouring the production of the discoloration both in ordinary Stilton cheeses and in the experimental cheeses treated with tyrosine. The writer has been able to isolate and identify tyrosine from yellow and red parts of Leicestershire Stilton cheeses, but the quantity present is not large, a fact which is further demonstrated by the large amount of colour produced by the injection of only 5 milligrams into a cheese (see Fig. 2). It is therefore probably impossible to demonstrate that the tyrosine was destroyed in the cheeses with little salt.

---

* A. W. Dox, "The Occurrence of Tyrosine Crystals in Roquefort Cheese" (*Jour. Amer. Chem. Soc.*, March, 1911, Vol. xxxiii, No. 3, p. 423).

The presence of tyrosine has already been demonstrated in many other kinds of cheese, but the agency by which it is split off from the casein has not yet been satisfactorily proved. Van Slyke found * more tyrosine present in Cheddar cheese ripened in an atmosphere of chloroform than in normal Cheddar cheese, which seems to indicate that the rennet-pepsin is the proteolytic agent to which the presence of the tyrosine is due; but other workers suggest that the proteolytic enzyme of the mould or of some other organised ferment is the active agent by which tyrosine is formed.

The source of the tyrosinase is suggested by the following experiment. A nutrient gelatine medium was prepared, and to this 0·5 per cent. of tyrosine was added. The medium was then sterilised, filled into tubes, and sterilised again. The organisms isolated from the various Stilton cheeses were then grown on this medium, a darkening in colour of the medium being taken to indicate the production of tyrosinase. This took place in three out of about 100 organisms tested. One of these was the organism above referred to as having caused some yellowing when a core of a Stilton cheese was infected with it. The others have not yet been tested in this way. Lehmann and Sano † have previously shown by the above method that certain organisms are able to produce tyrosinase.

---

* L. L. van Slyke and E. B. Hart, "The Relation of Carbon Dioxide to Proteolysis in the Ripening of Cheddar Cheese" (*New York Agric. Expt. Sta.*, Bull. No. 231, Feb. 1903, p. 33).

† K. B. Lehmann & Sano, Über das Vorkommen von Oxydationsfermenten bei Bakterien und höheren Pflanzen" (*Archive für Hyg.*, 1908, Vol. 67, pp. 99–113.

Conclusions.

(1) Yellow discoloration is a serious source of loss to the Stilton cheese industry.

(2) Much salt (10 to 15 oz.) seems to be a practical factor in the production of yellow cheeses. In dairies where 7 oz. of salt were used to 28 lb. of curd, the yellow colour was almost unknown in the cheeses, while in a dairy where 13 oz. per cheese were used, it was most abundant.

(3) Home-made rennets are used in many of the dairies where the trouble occurs. These rennets contain many organised as well as unorganised ferments, and a trial of the best commercial rennets, which contain less of the former and more of the latter, is recommended.

(4) As tyrosine injected into cheeses produced discoloration, the presence of this substance is probably a limiting factor. There is evidence that the accumulation of tyrosine is favoured by much salt in the cheese.

(5) Tyrosinase, the enzyme which acts on the tyrosine, is an oxidising ferment or oxydase, which accounts for faulty coats or fly-struck spots being likely places in the cheese for the trouble to start.

(6) There is evidence that tyrosinase may be produced by bacteria isolated from the cheese, and hence the greatest cleanliness should be observed in all the operations of cheese-making, including the preparation of the rennet.

Description of Plate.

Fig 1. *Discoloured Stilton Cheese.*—This cheese was made in Leicestershire on August 1st, 1911. Home-made rennet was used, and 11 oz. of salt were added to 29 lb. of curd. On September 27th it was first found to be turning yellow. It was cut open and a drawing made on November 1st.

Fig. 2. *Colour produced by Tyrosine.*—This cheese was made in Leicestershire on August 1st, 1911. Home-made rennet was used, and 11 oz. of salt were added to 26 lb. of curd. On February 22nd it was free from yellow discoloration, being a good cheese with blue veins. On this date it was injected at one end with :—

(1) 5 c.c. of water.

(2) 5 c.c. of ferrous sulphate (1 per cent. solution).

(3) 5 c.c. of tyrosine (0·1 per cent. solution).

On March 14th, when the cheese was cut open, the colours shown in the plate were found in every section under the tyrosine injection, but under the other injections the cheese was normal.

HOP GROWING ON THE PACIFIC COAST OF AMERICA.

ARTHUR AMOS, M.A.,
Department of Agriculture, Cambridge University.

II.

Soils.—The best hop-yards on the Pacific Coast are situated almost without exception upon rich, deep, alluvial soils lying close to the banks of the rivers. Many of these are flooded in winter, and a deposit of silt is left each year upon the surface. In consequence of the heavy rains and flooding it is impossible in many instances to commence any cultivation until the ground begins to dry in the spring.

The type of soil common to most of the hop-yards is a light sandy loam, though occasionally stronger soils are employed. These sandy soils are very much lighter than any of the hop-growing soils of England, and for this reason cultivation and the maintenance of a dry surface mulch of soil, so necessary in this hot climate to prevent loss of moisture by evaporation from the soil, are easily practised. Again, the hop soils are almost everywhere of great depth, and commonly the soil at a depth of 10 and even 15 feet is mellow and rich in humus. These soils are not sharply divided into surface soil and subsoil as in humid climates, and consequently the hop roots ramify to great depths in search of plant food.

Another factor of great importance common to all these soils is the high level of the subsoil water-table. Situated as these soils are, close to the banks of the rivers, the water-table, even at the end of the dry summer, is never at a very great depth. Further, because the texture of the subsoil is so mellow that the hop roots can penetrate to great depths, it rarely happens that the hop plants become seriously short of water.

Another point related to the depth and richness of these soils is the fact that until recently it has not been found necessary to manure the hop-yards at all, and growers' trials with artificial manures have in most cases given negative results. However, upon certain soils in Oregon, where hops had been grown for thirty years, I was informed by growers that the yield was gradually but surely falling, and some few growers were beginning to manure their hop-yards.

This description of the hop soils holds good for all the hop-yards I saw in California and in British Columbia, and in those hop-growing districts of Oregon lying close to the Willamette River. There is, however, another class of soils in Oregon devoted to hop-growing. These are the so-called "Prairie" soils, which are situated on the higher levels or benches, and at a greater distance from the Willamette River. The surface soil is rather closer in texture than that of the river soils, and it is neither so rich nor so deep as the latter. Below the surface soil at a depth of two or three feet is a layer of "hard pan" and clay, which prevents the roots from penetrating below it and so limits the supply of plant food. On account of the higher situation of these soils, the water-table is not near the surface, and for this reason, and also because the hard pan prevents the penetration of the roots, hops on these soils frequently become short of moisture, and a failure of the crop results. This was the case in 1911, when although the bottom yards produced good crops, the "prairie" yards were very poor. The average crop upon these yards only amounts to 5 cwt. per acre, and since even this low yield shows signs of diminishing, it is probable that hop-growing on these soils will gradually be abandoned.

Varieties.—The varieties of hops grown upon the Pacific Coast are in well-nigh hopeless confusion. It would seem that the ordinary grower pays no attention to the variety of hop which he grows. The most common so-called variety is the Cluster, old English Cluster or Californian Cluster as it is variously termed. It is by some supposed to be descended from the English "grape," but there is little evidence upon the point. In any case, many widely-different types are to be found in every hop-yard planted with clusters. Another variety sometimes grown is called the Canadian Red Vine, which, as its name implies, has a red bine. It is rather earlier than the Cluster. The best English varieties have from time to time been imported and tried, including Bramlings, Goldings, and Fuggles, but it has been found that they do not crop nearly so well as the Clusters, and that where a crop of Clusters will yield 15 cwt. per acre, the English varieties only produce 10 cwt. It was somewhat of a surprise to find that the Fuggle was a failure, since it is so prolific in England. Yet I learnt that this was so in many districts. Probably the character of the soil and the dryness of the climate account for its failure. In Oregon it has been tried on heavy, wet soils, but even here with no success. Many German varieties have also been tried, but with no better result.

In British Columbia more attention has been given to the varieties, and some of the English varieties have been successfully cultivated. Thus on the Coldstream ranch, Mr. Ricardo has grown Goldings, Bramlings, and Clusters in separate yards, and Mr. Hulbert, of Chilliwach, has also paid much attention to varieties, and has grown Bramlings successfully for many years.

It is likely that this confusion among the varieties will not last much longer. The United States Department of Agriculture has appointed an expert, Mr. James Thompson, whose whole time is devoted to the study of the question of the introduction of suitable varieties and other cultural problems. He has already raised large numbers of seedlings, from which in the course of time he will be able to select suitable plants from which to raise true varieties.

The value of the male hop has long been recognised, and for many years growers have made a practice of planting male hops in their yards, at the rate of about 1 male to 100 females, and in the low trellis one high pole is set to each male plant. The advantage of these poles is that the pollen can be more widely and more uniformly distributed by the currents of air over the female hops.

Planting.—Methods of planting adopted by growers on the Pacific are very different from those employed in England. In the first place, "sets," or yearling roots, are rarely, if ever, employed, while the "straps" or "cuttings" that are normally used in England for planting in beds in order to produce "sets," are not used for propagation. Instead of these "cuttings," the runners or underground shoots are everywhere employed. These runners are cut into lengths varying from 7 to 12 in., and planted at the rate of two or three to each hill.

The price of these cuttings varies from $1 to $10 per 1,000, depending upon the demand. The distance apart of the hills in all systems of training varies from 6 ft. to 8 ft., and in all cases planting is done so that horse cultivation can be carried out in both directions.

In California planting usually takes place in January or February, so as to ensure the runners being firmly set in the ground before the dry season sets in. In Oregon and Washington planting is usually done in March, the somewhat moister climate enabling the operation to be done at a later date. Little or no autumn planting is done on account of the heavy winter rains.

The actual planting is done by one of two methods, both of which are inexpensive. In the first method the planting is done with a spade. The spade is driven almost vertically into the ground at the point where the hill is to be planted. Without removing the spade a gap is forced open in the soil, using the spade as a lever, and then two or three cuttings are placed vertically in the gap, leaving the tops of the cuttings level with the surface of the ground. The soil is then trodden down tightly round the cuttings. In the second plan the cuttings are planted with the aid of a dibber.

It occasionally happens in California, when the season is very favourable, that a full crop of hops is obtained in the first year, though as a rule a yard does not come into full bearing until the second year. In Oregon, however, the climate is less forcing, and a full crop is not obtained until the third year; but, even so, development is very rapid, since cuttings, and not nursery sets, are always employed.

Pruning.—This operation is usually performed after the ground has been twice ploughed (once in each direction and away from the hills). In the most primitive and certainly the least expensive method, pruning is done with a sharp spade. Four cuts are made with the spade round the hill, and sloping away from the top of it, so that a square of 6 in. is left at the top and about 12 in. at the bottom. No care is taken to cut off the straps, and these are used later on for fastening the strings to the ground. The accompanying photograph (Fig. 1) shows a gang of Japanese pruning hills in this way.

Fig. 1—Pruning with Spades

Fig. 2—The High Trellis.

The above practice is commonly employed by large growers when prices are low, but when prospects are good greater care is usually taken; the soil is cleaned away from the hill with a hoe, and the straps and runners are cut off with a knife. In this case also it is quite a common practice to leave one strap uncut, to which the string is tied instead of to a peg. After pruning, the hill is covered to a depth of 1 in. to 3 in. with loose soil.

Generally speaking, too little care is employed in the operation of cutting. Dead and diseased hills are not carefully grubbed out and replanted, and one is struck by the frequent gaps which occur in the yards at the time of training.

Cultivation.—Probably the production of a successful crop of hops on the Pacific Coast depends more upon the cultivation than upon any other one factor. It will be remembered that the climate of most of the districts is semi-arid, and that for six months of the year there is little or no rain, combined with almost incessant sunshine and intense heat.

Under these conditions it can readily be understood that the moisture contained in the soil plays an all-important part in the growth of plants. If the supply is adequate plant growth is very rapid in the hot climate, but if insufficient then the plants become stunted and dried up. The aims of the hop grower must therefore be directed to economising the soil moisture as far as possible.

Now it is a well-known fact that water evaporates very rapidly from a compact surface of soil. If the surface soil is kept compact upon the subsoil, as soon as water is evaporated from the surface, more water is continuously drawn up from the subsoil by capillarity to take its place, and, so long as there is an adequate supply of water in the subsoil the surface soil is kept cool and moist. In a short time, however, the subsoil water is expended, and thus the whole soil, surface and subsoil, becomes completely dried out, and vegetation ceases. If now the top three or four inches of soil be broken up and finely divided, and allowed to get perfectly dry, it forms what is known as a "dust mulch," through which very little water can be evaporated into the air from the moist soil below it. It is therefore the primary aim in all cultivation, whether of fruit, hops, or any other crop in semi-arid climates, to obtain a "dust mulch," and so retain as much of the soil moisture as possible for the uses of the plant.

The other reasons for cultivation, the destruction of weeds and the aeration of the soil, though naturally attained by the maintenance of a dust mulch, are of secondary importance. Nevertheless, it is true that the weed known as Morning Glory, a species of *Convolvulus,* causes trouble in some of the hop-yards of California.

The ideal time for commencing cultivation is as soon as the ground is fit after the last heavy rain. Naturally this time is not always easy to decide, and varies in different districts, but for the most part the seasons are fairly constant. If the work is commenced too soon, and a heavy rain follows, not only does the cultivation have to be repeated, but the soil does not break up so kindly at the second attempt. On the other hand, if cultivation is delayed too long, much moisture is lost by evaporation, and the ground ploughs up rough and requires much breaking.

Cultivation is always commenced by ploughing the ground towards the centre of the alley and away from the hills, and then repeating the operation at right angles. This ploughing is always done with a two-horse plough, the horses being driven abreast with reins. After each ploughing, before the ground gets dry and caked, light harrows are employed to break down the furrow slices.

After the ploughings and harrowings are completed the next operations will depend upon the condition of the soil. If it is hard and lumpy an implement known as a "clod-masher" will commonly be employed. This implement consists of a framework, to the lower side of which hard wooden boards are fixed. The framework is weighted, and the implement, being drawn over the surface like a sledge, serves to crush the clods in its path.

If, however, the soil is friable the clod-masher is dispensed with, and the cultivation is continued with a disc-harrow. This is an implement very largely employed in all sorts of field cultivation in America, and certainly does very good work in the hop-yards. These implements are indispensable for the purpose for which they are employed, since they tend to leave the surface soil, to a depth of 2 or 3 inches, lightly resting upon a firm substratum, and thus produce an excellent "dust mulch."

In order that this mulch may be kept in perfect condition, it requires to be frequently moved, and the cultivators and disc harrows are kept going until the lateral branches of the hops are well formed, after which time it becomes impossible to take the implements through the gardens owing to the dense foliage.

One team of horses and one man are employed to cultivate in this way from 15 to 30 acres of hop land; such a team, with the teamster, costs from $20 to $25 per week, approximately $4 (16*s*. 8*d*.) per day. On the light soils a team will plough 2 acres a day, reckoning the hill rows; thus ploughing costs $2 per acre. Disc harrowing costs about 40 cents per acre.

It will be remarked that no mention has been made of manual cultivation. Very little of this is necessary, since the plough and cultivators are taken very close to the hills. In fact, no hand cultivation is done except that perhaps once in the season the hills may be lightly hoed with a broad hoe to kill any chance weeds.

Irrigation.—It has been mentioned in the first part of this article that the average annual rainfall in the Yakima district of Washington does not normally amount to 10 in. during the year, and that in consequence irrigation has to be practised in order that the hop-plants may obtain sufficient moisture to produce a crop. The method by which hops are normally irrigated is called Furrow-Irrigation, and is largely practised for both fruit and hops in these dry districts. In order that irrigation by this method may be successfully carried out, it is necessary that the ground should lie upon a gentle slope. The water is led by means of ditches, cut in the ground, from a reservoir to the top side of the sloping ground, which is to be irrigated, and from these ditches it is led to a series of plough furrows, which traverse the hop alleys, and down which the water runs. The rate at which the water is allowed to enter these furrows is adjusted so that the water just reaches the end of the furrow before it has all soaked away into the adjoining soil. Generally two irrigations are given during the season, one at the beginning of June, and the other at the end of July. It is found that one good soaking is more valuable than several small irrigations, because that part of the water which soaks into the subsoil can be retained for the use of the crop by the help of a dust mulch, whereas the moisture in the surface soil is soon lost by evaporation. Thus the amount of water applied usually amounts to 6 in. over the whole field at each irrigation.

Some few of the growers in Oregon and California, where the total annual rainfall is much larger than in the Yakima districts, have also installed irrigating plants for the purpose of irrigating their yards during the dry season.

Systems of Training.—There are two systems of training in common use on the Pacific Coast, differing very widely in their characteristics. The one is known as the "Low Trellis" and the other as the "High Trellis."

As its name implies, the *Low Trellis* is low, the top of the poles being as a rule from 6 to 8 ft. above the ground. The poles are made of split cedar or fir, square in cross-section, the sides of which are 2 or 3 in. in width. One pole is set to each hill, and the tops of these poles are joined by strings.

The accompanying photograph (Fig. 3) serves to illustrate the manner in which the strings are fixed to the poles. It will be noticed that the string is perfectly horizontal, so that the hop-bines are not able to climb upon it of their own accord. In such trellises the male hills are usually marked by taller poles, upon which the male bines are trained, so that the pollen may be more advantageously distributed.

The chief advantage of this system is the low initial cost. Lumber is cheap in most parts, and the initial cost of 1,000 poles would be perhaps from £5 to £8. Again, the amount of string for the low trellis is relatively small. To counteract these advantages, the cost of training the hop bines up the poles and along the horizontal strings is relatively high, and generally speaking smaller crops are produced on the low trellis.

This system is largely employed by the smaller growers in the Sonoma district, and also in Oregon. The "Prairie" yards in the latter State are almost always trained upon this system, since in these yards growth is less vigorous. On the richer soils this trellis is not now employed by the larger growers, because it requires much more labour for training,

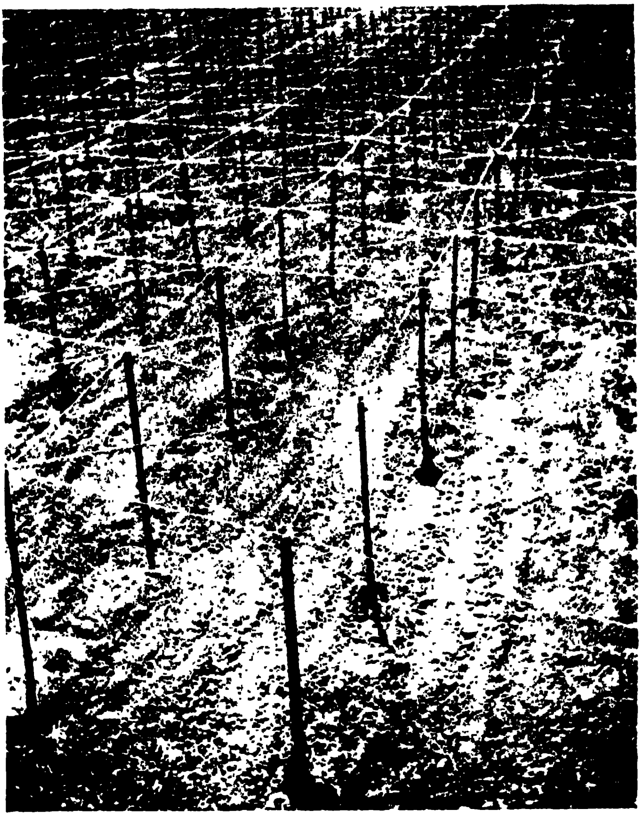


FIG. 3 THE LOW TRELLIS.

is more difficult to cultivate, and does not allow sufficient scope for the development of the bine.

The construction of the *High Trellis* resembles in many ways the construction of the wirework on the Worcester System. The straining poles at the outsides are set at a considerable angle from the perpendicular, and are well secured by anchors. The cross-wires or cables which run across the garden and support the string wires are made of solid iron resembling a stout fence wire. The string wires, made of the same material, are slighter, and instead of two string wires to each alley, as in the Worcester System, only one is employed; this may be set immediately above the hills or in the centre of the alley, according to the style of stringing. These string wires are supported by the cross wires, and are in some cases permanently fixed to them, but in the most modern systems the string wires are attached to the cross-wires by S-shaped hooks, so that they may be let down for stringing and for picking.

Fewer poles are used for this trellis than for wirework in England. In California one pole to every sixth or seventh hill in either direction is necessary, making from 20 to 30 poles per acre, but in British Columbia, where rain is more frequent, and the foliage is more luxuriant, rather more strength is necessary, and 40 poles are usually set per acre. These poles are also made of split fir or cedar, and have a cross-section of about 5 or 6 in. The accompanying photograph (Fig. 2) illustrates the general appearance of the trellis.

The height of the trellis varies from 13 ft. to 18 ft., but owing to the paucity of poles and the sag of the wire, it generally sinks 1 or 2 ft. under the weight of the bine. The cost of the trellis amounts to from £8 to £12 per acre, but owing to its numerous advantages it is far superior to the low trellis. In addition to the lower cost of training, and the superior development of the hops, washing can be practised much more advantageously when necessary.

(*A continuation of this article will appear in a subsequent number of the Journal.*)

THE FEEDING OF FARM STOCK.

CHARLES CROWTHER, M.A., Ph.D.,
Leeds University.

PART V.—RATIONS FOR YOUNG CATTLE AND FOR SHEEP.

YOUNG CATTLE.

For general principles see Vol. XVIII., p. 985.

The rearing of calves is dealt with fully in Leaflet No. 142, so that only a summary is necessary here.

Calves should be kept on new milk for the first two weeks of their lives, after which they may be put on to mixed new and separated milk. After the fourth week they begin to nibble at hay, and can be well kept on two gallons per day of separated milk, to which is added three tablespoonfuls (2 oz.) of cod liver oil. At ten weeks the oil may be discontinued, and the calf will then have to depend mainly on the carbohydrates of the hay for the heat and fat-producing matter of its food. A little linseed cake, meal, and pulped swedes in winter, or grass in summer, should gradually be introduced, so that at six months old milk may be discontinued altogether if necessary. The calf will now thrive well up to a year old on a ration of hay, swedes (or grass in summer) and mixed linseed cake and meal in quantities similar to those indicated below. On milk-selling and cheese-making farms, however, separated milk is not available, and recourse has to be had to milk substitutes or calf-meals to rear the heifer calves intended for breeding. There is no difficulty in compiling from our food table a meal that shall closely resemble milk in its digestible constituents, but it cannot be done without at the same time introducing a much larger amount of indigestible matter than occurs in milk; this, and the question of choosing meals that will agree with the calf's stomach, constitute the practical difficulty of rearing calves without milk.

Calf Meals.

The following mixtures have proved to be good milk substitutes, giving an albuminoid ratio about the same as that of new milk:—

1.—Linseed Cake Meal	14 parts by weight
Crushed Linseed	5 ,, ,,
Wheat Flour	2 ,, ,,
Locust Bean Meal	2 ,, ,,

---

[*] This part of the article is largely based upon Leaflet No. 79, but much new matter has been included.

This may be prepared by mixing 3 lb. with 5 qts. of boiling water and a sprinkle of salt, say ½ oz., for the day's allowance of one calf, and be given at three meals for calves under three months old, and at two meals for calves above that age.

2.—Linseed Cake Meal	2 parts
Oatmeal	2 ,,
Crushed Linseed	1 ,,

3 lb. should be mixed with 5 qts. of boiling water over-night and stirred and boiled for ten minutes next morning, and then served at three or two meals with salt and 2 oz. of sugar.

Where a small quantity of separated or skim milk is available:—

3.—8 Parts of Oatmeal
1 Part of Crushed Linseed

In this case 2¼ lb. should be scalded over-night with 5 pints of boiling water, and boiled for ten minutes next morning; 5 pints of separated milk should then be added with about ¼ oz. of salt and 2 oz. of sugar; this will suffice for one calf for one day.

The following data give a rough measure of the requirements (per 1,000 lb. live-weight per day) of young cattle at different stages of growth. The upper limits refer to animals that are to be fattened off when full-grown, whilst the lower limits apply to heifers that are to be drafted into the dairy herd, or young bulls, which require to be kept in a well-nourished but not fat condition.

Rations per 1,000 *lb. Live-Weight per Day.*

			Digestible			
Age (months).	Live-Weight per Head. stones.	Total Dry Matter. lb.	True Albuminoids. lb.	Starch Equivalent. lb.	Oil. lb.	Carbohydrates. lb.
2—3	10—12	23	3·5—4·5	18·5—19·5	2·0—2·3	13·0—13·2
3—6	20—23	24	2·8—3·5	14·7—17·5	1·0—2·0	13·0—13·2
6—12	38—39	26	2·3—2·8	12·5—14·5	0·6—1·0	12·7—13·0
12—18	50—55	26	1·8—2·2	10·5—11·2	0·4—0·5	12·4—12·5
18—24	63—68	26	1·3—1·5	9·2—10·0	0·3—0 4	12·0—12·2

It will be noted that, in accordance with the general principles previously outlined (Vol. XVIII., p. 986), the change in the ration (per 1,000 lb. live-weight) as the age advances consists mainly in a reduction of the amounts of albuminoids and oil supplied, the proportion of carbohydrates being kept practically constant. If it is desired to have the animal quite fat before or on reaching maturity, the above rations—which are rearing rations—will need to be increased by more liberal supplies of carbohydrates and a correspondingly enhanced starch-equivalent, until at two years old the animal is placed upon a fattening ration somewhat richer in albuminoids, but otherwise little different from that of the adult animal (*Journal*, May, 1912, p. 114).

The following are specimen rations per head per day that conform to the above requirements:—

AGE, 3-6 months.

4.—	7	lb.	Meadow Hay
	7	,,	Swedes
	1	,,	Crushed Oats
	1½	,,	Linseed Cake
5.—	7	lb.	Meadow Hay
	14	,,	Swedes
	1	,,	Malt Culms
	1½	,,	Linseed Cake
6.—	10	lb.	Meadow Hay
	7	,,	Swedes
	1½	,,	Linseed Cake

AGE, 6-12 months.

7.—	10	lb.	Hay
	14	,,	Swedes
	2	,,	Oat Straw
	2	,,	Linseed Cake
	1	,,	Soy Bean Cake
8.—	7	lb.	Hay
	7	,,	Swedes
	3	,,	Oat Straw
	2	,,	Ground Oats, Barley or Wheat
	1½	,,	Pea Meal
	1½	,,	Soy Bean Cake
9.—	40	lb.	Green Clover or Vetches
	4	,,	Oat Straw
	2	,,	Bran
	1¼	,,	Linseed Cake

AGE, 12-18 months.

10.—	7	lb.	Hay
	7	,,	Oat Straw and Chaff
	14	,,	Swedes
	2	,,	Ground Oats, Barley or Wheat
	1½	,,	Linseed Cake
	1½	,,	Soy Bean Cake or Decorticated Cotton Cake
11.—	10	lb.	Hay
	5	,,	Oat Straw and Chaff
	21	,,	Swedes
	1½	,,	Malt Culms
	2	,,	Decorticated Cottonseed Meal or Soy Bean Cake
12.—	50	lb.	Green Vetches
	8	,,	Oat Straw
	2	,,	Wheat Meal
	1	,,	Maize Meal

The conditions of feeding young cattle under cover differ greatly, of course, from those that obtain when the animals run on grass.

Weaners on grass require no more than from ½ to ¾ lb. mixed linseed cake and meal each per day in addition to grass to keep them in good thriving condition.

Yearling bullocks that are intended to be house-fed for early beef of, say, about 8 cwt. live-weight at about nineteen months old, should have a diet similar to one of the above for calves rising a year old, steadily increasing until they finish with two-thirds of the ration of a full-milking Shorthorn cow. The same feeding is suitable for fattening Irish heifers.

At about fifteen months old the fattening yearling would in this way be receiving a diet like No. 13; and at eighteen or twenty months of age, when finishing for the butcher, a ration like No. 14 would be suitable.

13.—21 lb. Swedes
7 ,, Hay
2 ,, Oats
3 ,, Linseed Cake

14.—35 lb. Swedes
10 ,, Oat Straw
3 ,, Maize, Barley or Wheat
3 ,, Linseed Cake
2 ,, Decorticated Cotton Cake

Yearling store bullocks and heifers turned out to grass in the spring require no extra food, but should come in full of flesh in late autumn. For wintering yearling stores a liberal allowance of turnips and straw, with from 2 to 4 lb. per day each, according to size, of mixed decorticated cotton cake (or soy bean cake) and meal, should be given in order to produce well-grown and "fresh" beasts for the spring store sales. If, however, they are intended for the fat market in the new year, when close upon two years old, they will require more liberal feeding, and by the beginning of December will pay for a ration of five-sixths that of a cow in full milk, such as:—

15.—42 lb. Swedes
14 ,, Oat Straw
3 ,, Maize Meal or 3½ lb. Crushed Barley or Rice Meal
4 ,, Decorticated Cotton Cake or 5 lb. Linseed Cake

16.—35 lb. Yellow Turnips or 21 lb. Cabbages
7 ,, Hay
7 ,, Oat Straw
6 ,, Dried Grains
4 ,, Crushed Oats or 3½ lb. Crushed Oats
¼ ,, Linseed

17.—21 lb. Mangolds
18 ,, Oat Straw
4 ,, Crushed Oats
3½ ,, Decorticated Cotton Cake
2 ,, Rice Meal or Barley Meal

SHEEP.

The following data will give guidance as to the food-requirements of sheep. The amounts represent daily rations per 1,000 lb. live-weight, the lower limits being intended for the finer breeds (wool breeds) and the upper limits for the coarser breeds (mutton breeds).

Rations per 1,000 lb. Live-Weight per Day.

Age (months).	Live-Weight per Head.	Total Dry Matter.	Digestible.			
			True Albuminoids.	Starch Equivalent.	Oil.	Carbohydrates and Fibre.
	lb.	lb.	lb.	lb.	lb.	lb.
5—6	60—65	27—28	3·0—4·5	16·4—17·2	0·8—1·0	15·6—15·8
6—8	75—85	25—27	2·5—3·5	13·0—15·4	0·6—0·7	13·5—15·0
8—11	85—100	23—26	1·8—2·5	10·7—13·8	0·5	11·5—14·5
11—15	90—120	22—25	1·5—2·0	10·2—11·4	0·4	11·3—12·5
15—20	100—150	22—24	1·2—1·5	9·7—10·2	0·4	11·0—12·0

The needs for the maintenance of life and the production of wool in the case of full-grown sheep will be satisfied by a daily ration supplying (per 1,000 lb. live-weight) about 1 to

1·2 lb. digestible albuminoids and 8½ to 9 lb. starch-equivalent.

The growth of wool will not be affected by the feeding so long as the live-weight of the animal is maintained. Liberal feeding may give a heavier fleece, but the difference will be due more to increased deposition of wool-fat than to extra growth of wool fibre.

In Scotland and over a large portion of the north and west of England, ewes wintering on grass require no more than a rack of hay; they generally get mangolds and turnip-tops thrown out to them, and are run over the root land, after the roots have been pulled and carted off, to clean up small ones and stray leaves. As soon as they lamb they require, in order to keep up their milk supply and flesh, a ration with an albuminoid ratio of about 1 to 5 or 6, and containing about 2 lb. of digestible true albuminoids per ewe per week. This is generally provided in the first three months of the year by means of swedes or mangolds, bean or pea straw, or mixed hay and straw chaff (oat or barley) and peas, linseed cake, oats, bran, &c.

The following rations supply the requirements of seven ewes for one day, or one ewe for a week; the quantity and quality of the digestible matter is almost the same as that of the cow rations, but as the ewe will get nearly all her water from the roots supplied, something like three times as many are given her for a week as to a cow for a day:—

1.—126	lb.	Swedes	2.—126	lb.	Swedes
7	,,	Hay and Straw Chaff	2	,,	Pea Straw
3	,,	Linseed Cake	2	,,	Hay
2	,,	Decort. Cotton Cake	6	,,	Peas

3.—84	lb.	Mangolds
6	,,	Hay
4	,,	Oats
4	,,	Bran
2½	,,	Decorticated Cotton Cake

When the ewes and lambs are put on a good spring pasture they no longer require trough feeding; but should they be inclined to scour it would be well to continue oats for a while. As the ewe's milk diminishes the lambs should be kept progressing after July with about a pound of linseed cake or cracked peas to every seven lambs per day. When ewes or lambs are placed on clover aftermath they fatten without auxiliary food.

In the case of the various "Down" breeds of sheep in the south of England, lambing usually takes place in January. After lambing the ewes and lambs are folded on roots, and the ewes are allowed about 1 to 1½ lb. of sainfoin or meadow hay per day, and about the same quantity of concentrated food, consisting, say, of linseed cake, peas and pollards, or dried grains and oats. During the spring months the sheep are folded on rye, trifolium and rape, with an allowance of mangolds. In summer the food will be vetches and rye grass, and in autumn rape, with a run each day on old leys. As the lambs become independent of milk, the allowance of concentrated food to the ewes is gradually dropped. Dried grains are an excellent food for ewes, and an admixture of malt dust with hay chaff not only supplies extra nourishment, but also renders the chaff more palatable.

Fattening Sheep.

The following points should be considered in the successful fattening of sheep: (1) a mixture of two or more concentrated foods is better than one concentrated food alone; excellent mixtures can be made from linseed cake, decorticated cotton cake, dried grains and maize; (2) the allowance of cake and corn should be gradually increased as the fattening process continues, commencing with, say, 2 lb. per head per week, and finishing with, say, 6 to 10 lb. according to the size of the sheep; (3) a monotonous diet should be avoided, and this refers to both green food and trough food; (4) the greater the amount of bulky food consumed, the more rapid and economical will the fattening process be.

The food-requirements of fattening young sheep may be set out roughly as follows:—

Rations per 1,000 lb. Live-Weight per Day.

			Digestible			
Age (months)	Live-weight per Head.	Total Dry Matter.	True Albuminoids.	Starch Equivalent.	Oil.	Carbohydrates and Fibre.
	lb.	lb.	lb.	lb.	lb.	lb.
6—7	66	31	3·5	17·0	0·8	16·0
7—9	88	30	3·0	16·0	0·7	15·0
9—11	110	28	2·5	15·0	0·7	14·5

Hoggets (tegs) are extensively fattened during the winter on turnips or swedes, and experience has shown that the fattening is done much more economically, and with fewer losses by death, when dry foods are given in gradually increased quantities with the roots, and the roots are cut and measured out to the sheep. The cutting of roots is a much commoner practice in the north than in the south. Cakes and grain should be well broken or bruised.

Young sheep fattening for the butcher usually consume from 100 to 160 lb. of roots or green food, such as cabbages or rape, per head per week, and from 3 to 8 lb. of hay, or hay and straw. The consumption of concentrated food varies from 2 to 10 lb. per head per week, being on the average about 5 lb. The following is a typical weekly ration for a fattening sheep belonging to one of the larger breeds, such as Hampshire Down or Leicester:—

126 lb. Swedes
5 ,, Hay and Straw Chaff
3 ,, Crushed Barley
2 ,, Decorticated Cotton Cake

The following are examples of suitable mixtures of concentrated foods to be given along with green food (including roots) and hay, or hay and straw. The quantities are suitable for one sheep for a week, on the average of the fattening period.

2 lb. Maize
2 ,, Decorticated Cotton Cake

3 ,, Dried Grains
2 ,, Linseed Cake

2 ,, Malt Coombs
2 ,, Maize, or Barley
1 ,, Decorticated Cotton Cake, or Linseed Cake

3 ,, Wheat or
  2 lb. Wheat
  1 ,, Malt Coombs
3 ,, Undecorticated Cotton Cake

3 ,, Peas or Cocoanut Meal
2 ,, Dried Grains

Where sheep are growing rapidly, and at the same time putting on flesh—such as is the case with ram lambs to be sold for service at about eight months old—there must be plenty of variety in the diet, and the trough food must be rich in flesh-forming material. A good mixture for this purpose is linseed cake and peas, with or without malt coombs.

In certain parts of Scotland sheep are regularly fattened without the addition of hay or straw to the ordinary diet of turnips and cake, &c. The high quality of the roots grown in these districts largely accounts for the success of this system. Where there is a good market for hay, a modification of the system could be followed in other parts of the country by substituting dried grains for a portion of the hay, or by giving dried grains and straw chaff instead of hay.

PIG CLUBS IN ENGLAND AND WALES IN 1910.

There are in England and Wales over a thousand co-operative societies for the insurance of pigs, generally known as Pig Clubs. In 1905 it was ascertained that such clubs existed in twenty-six counties, and that they were most numerous in Lincoln (309), Northampton (114), and Wiltshire (112). The great majority of them are unregistered, and maintain themselves simply as private associations of individuals, without any legal standing or outside help. Registration under the Friendly Societies Acts would cost them nothing, and while it would require them to submit their rules and annual accounts for scrutiny to the Registrar, it would give them a stronger control over their members, and would afford the members themselves better security in the knowledge that their accounts were kept on a proper system, and regularly audited.

At the end of 1910, only 32 Pig Clubs were registered, and detailed statistics are available for 31 of these, of which 16 are in Lincolnshire, and 5 in Gloucestershire, while the others are scattered over seven counties. These 31 clubs, of which 9 have been at work for more than forty years, had 1,598 members, an average of 52 members per club; and insured altogether 3,118 pigs, an average of 101 pigs per club, and of two pigs per member. The smallest club, with 9 members, insured 14 pigs, and the largest, with 60 members, insured 632 pigs. During the year these clubs received in premiums from members £299, an average of 1*s.* 11*d.* per pig insured. The income of their insurance funds also included £27 for entrance fees and fines, £44 for interest, £51 for sale of carcasses and some other items, and amounted altogether to £460. On the other hand, they paid £348 to members on claims for pigs that died, an average amount of 2*s.* 3*d.* per pig insured. Three also paid out of this fund in dividend to members £52 during the year, and some clubs irregularly charged to it costs of management which should have been met otherwise. One club treated itself to a supper at a cost of 16*s.* The total charges against the insurance fund as entered in the returns was £444, thus showing a surplus for the year of £16; so that the balance at the credit of this fund increased from £1,941 at the beginning of the year to £1,957 at its close. Eliminating other items of receipt and expenditure, the income from premiums and sale of carcasses was £351, so that it just covered the amount paid on claims, £348, and, like that main charge, averaged 2*s*. 3*d*. per pig insured.

Under the Friendly Societies Acts the account for costs of management should be kept separate from the insurance fund account. The 20 societies which complied with this provision spent on costs of management £67, including £32 paid in salaries, the highest amount expended under this head being at Louth, where, with 200 pigs insured, £5 5s. was paid in salaries. These 20 societies insured among them 2,312 pigs, so that their costs of management averaged 7*d*. per pig insured. Of the larger clubs, Werrington, with 205 pigs, spent on costs of management £8 13*s*., an average of 10*d*. per pig; and Louth, with 200 pigs, spent no less than £11 14*s*., an average of 1*s*. 2*d*. per pig. The income of the management fund of the 20 societies amounted to £72, partly derived from entrance fees, marking fees, and donations (£11), but mainly from special contributions made towards management expenses by members, which amounted to £48 for 18 societies insuring 2,170 pigs, and averaged 5*d*. per pig.

With the exception of small sums retained in the treasurer's hands for current expenses, the reserves of these 31 societies were deposited in the Savings Bank, and brought them in £44 in interest. Their gross assets at the end of the year amounted to £2,019, against which there was no outside liability. Of this, £62 represented savings in the management fund, and £1,957 was the balance at credit of the insurance fund, enough to meet more than five times the insurance losses of the year. All the 31 societies had a balance to their credit, the largest being at Kemerton, in Gloucestershire, which, with 109 pigs insured, had £176 in the Savings Bank, enough to pay the losses of the year twenty times over.

The most important question in the working of such an insurance society is the rate of mortality among the insured pigs. Statistics on this point are available for 25 societies, insuring 2,560 pigs, of which 102 died during the year, giving a death-rate of 4 per cent. The experience of the different societies, however, varied greatly on this point. Six societies insuring 426 pigs had no deaths at all during the year; on the other hand, among the larger societies, Calne, with 632 pigs, and Louth with 200, had each a death-rate of over 6 per cent.

The next point of importance is the amount that a society will be called on to pay on the death of a pig. Most societies pay the full value of the animal at the time it fell ill; in their case the average amount paid on 70 pigs was £2 7*s.* per pig, but in several societies the amount paid averaged over £4 per pig, and one society paid £5 12*s.* on a single pig. A number of societies pay only a proportion of the value of the pig, varying from two-thirds to nine-tenths. Altogether, on 102 pigs, the amount paid averaged £2 10*s.*

Thus the net result of the working of these 31 pig clubs for the year 1910 was that their members, by making payments amounting in all on the average to 2*s.* 4*d.* per pig insured, secured payment of compensation for all their pigs that died from disease or accident during the year, averaging £2 10*s.*, and in some cases amounting to £5 or over. Some societies have, by good management, and the building up of a substantial reserve fund, attained a much more satisfactory position than this. For instance, two clubs at Kemerton, in Gloucestershire, and Bredon, in Worcestershire, both having large reserve funds, now realise, from members of four years' standing, only 8*d.* a year altogether, and in return for this merely nominal subscription guarantee to them payment of the full value of any of their successive pigs that may die from disease or accident; the chief secret of their success in thus reducing the annual charge being that, according to the average of the last ten years, the death-rate per 100 pigs insured has been in Kemerton only 0·9, and in Bredon only 1·2 per annum. Although in one case as much as £8 5*s.* was paid on a single pig, the total payments on claims during the ten years averaged at Kemerton only 9*d.*, and at Bredon only 10½*d.*, per annum per pig insured.

The large insurance companies, which deal with the insurance of live stock, generally charge a premium of 5 per cent. on the maximum amount payable on the death of a fattening or store pig, and 7½ per cent. in the case of a breeding sow or boar, and this premium does not cover the risk of death from fire or lightning. Usually they refuse to insure pigs under six months old, and one company at least declines to insure pigs unless horses or cattle are also insured. The pig

STATISTICS OF REGISTERED PIG

Serial Number.	Name of Society.	County.	Year of Registration.	Number of Members.	Number of Pigs Insured.	Number of Pigs on which Claims were Paid during the Year.	Insurance					
							Amount at Beginning of the Year.		Income.			
									Received in Premiums.		Entrance Fees and Fines.	
							£	s.	£	s.	£	s.
1	Langworth	Lincoln	1859	36	61	4	44	1	6	17		
2	Kirton in Lindsey	Lincoln	1862	53	81	9	80	6	9	11		16
3	Conisborough	York	1863	20	40	—	20	7	6	1		9
4	Aberford	York	1865	69	50	5	13	4	10	1	1	6
5	First Billinghay	Lincoln	1865	54	91		99	18	9	14	3	8
6	Bucknall	Lincoln	1866	27	50	2	49	10	2	8		15
7	Nocton	Lincoln	1866	25	37	3	33	18	7	6	1	0
8	Bardney	Lincoln	1866	27	30	5	19	6	7	18	—	
9	Scawby	Lincoln	1870	39	55	2	126	11	6	0		4
10	Hugglescote	Leicester	1872	78	78		10	0	50	2	--	
11	Blankney	Lincoln	1873	14	22		95	5	—		--	
12	Bredon	Worcester	1878	93	136	--	139	2	5	6	-	
13	Werrington	Northampton	1878	130	205		119	3	9	13	7	0
14	Caistor	Lincoln	1881	42	53	1	47	12	12	6	—	
15	Sutterton	Lincoln	1881	87	124	1	138	13	17	1	1	17
16	Eckington	Worcester	1886	32	37	—	62	19	3	13		9
17	Kemerton	Gloucester	1887	81	109	2	173	8	5	8	1	0
18	Crowland	Lincoln	1887	87	116		15	1	26	13	2	1
19	Billinghay & District	Lincoln	1888	70	121	4	60	19	12	4		4
20	Walcot	Lincoln	1889	35	46		65	11	3	1	--	
21	Old Fletton	Huntingdon	1890	52	123	1	66	11	4	16	3	14
22	Amber Hill	Lincoln	1890	9	14	1	20	0	3	0		2
23	Beckford	Gloucester	1890	34	45	2	65	19	2	1		5
24	Louth	Lincoln	1891	88	200	13	121	13	10	15		5
25	Horsington Victoria	Lincoln	1891	19	36	4	14	13	2	12		2
26	Stanway	Gloucester	1894	58	122	—	51	2	8	2		6
27	Winchcombe	Gloucester	1904	37	56	—	30	2	3	0		8
*28	Wiltshire	Wiltshire	1905	—	--	—	—		—		—	
29	Kingsthorpe	Northampton	1906	100	150	3	94	11	9	19		16
30	Dumbleton	Gloucester	1906	24	35	--	9	7	2	6		3
31	Calne	Wiltshire	1906	60	632	39	19	7	36	16		12
32	Cobholm	Norfolk	1910	18	157	1	32	17	4	17	—	
	Total of 31 Societies			1598	3118	102	1940	16	299	7	27	2

* Being wound up.

INSURANCE SOCIETIES FOR 1910.

Fund.						Management Fund.				Assets.		
Income.			Expenditure.		Amount at the end of the Year.	Income.		Expenditure.				
Interest.	Sale of Pigs and Carcasses.	Total Income.	Paid on Claims.	Total Payments.		Contributions and Levies.	Total Income.	Salaries.	Total Expenditure.	Investments and Cash in Bank.	Total Assets.	Serial Number.
£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	
19	5 5	13 1	17 6	17 6	39 16	—	2 6	1 10	3 1	39 12	40 6	1
1 18	—	12 5	20 18	20 18	71 13	—	3 8	1 10	1 10	74 9	81 10	2
10	—	7 0	—	6 11	20 16	—	—	—	—	20 12	20 16	3
—	4 17	16 8	15 3	16 8	13 4	—		—	—	8 10	13 4	4
—	—	15 4	21 8	26 0	89 2	—	—	—	—	85 19	89 2	5
1 1	—	4 4	8 10	8 10	45 4	2 0	2 6	10	2 17	42 15	45 5	6
—	—	9 11	12 0	20 8	23 1	—	—	—	—	20 6	23 1	7
—	2 4	10 2	13 9	13 9	15 19	1 4	1 4	1 4	2 0	—	15 19	8
3 4	1 0	10 9	5 12	5 12	131 8	—	—	—	—	131 4	131 8	9
1 0	—	51 2	4 0	51 2	10 0	—	—	—	—	10 0	10 0	10
2 4	—	2 4	5 0	5 16	91 13	2 3	3 17	1 0	1 18	91 3	93 11	11
3 10	—	8 16	—	—	147 18	2 18	3 14	2 9	3 2	147 12	149 11	12
2 18	3 10	23 1	17 11	17 11	124 13	2 13	8 13	2 14	8 13	117 19	124 13	13
1 3	3 19	17 8	5 12	11 18	53 2	2 16	3 11	2 15	4 8	44 16	56 18	14
3 1	—	22 14	9 13	11 12	149 15	—	—	—	—	133 14	149 15	15
1 13	—	5 15	—	—	68 14	1 0	1 1	7	13	70 5	72 5	16
4 7	—	10 16	9 0	9 0	175 4	2 10	2 10	1 0	1 13	176 2	176 2	17
—	—	31 11	40 11	40 11	6 1	2 12	4 6	2 4	4 6	5 14	6 1	18
1 5	3 7	20 5	15 9	20 18	60 6	—	—	—	..	60 6	60 6	19
1 15	—	5 2	4 8	8 6	62 7	—	—	—	—	58 15	62 7	20
1 12	—	10 9	2 2	4 1	72 19	1 1	3 0	1 10	3 0	65 17	72 19	21
—	2 0	5 12	5 0	5 12	20 0	—	—	—	—	20 0	20 0	22
1 11	—	3 17	4 16	4 16	65 0	1 2	1 2	19	1 6	65 0	65 12	23
3 0	19 11	45 0	37 14	37 14	128 19	12 9	14 9	5 5	11 14	124 14	139 19	24
5	2 12	5 11	12 0	12 6	7 18	7	8	—	5	9 2	9 2	25
1 3	—	9 11	—	—	60 13	1 16	2 3	1 0	1 12	52 3	61 12	26
—	—	5 13	—	3	35 12	1 0	1 7	1 0	1 14	31 8	36 15	27
—	—	—	—	—	—	—	—	—	—	—	—	28
3 16	19	19 18	4 7	6 17	107 12	—	—	—	..	107 12	107 12	29
—	—	9 2	—	16	17 13	15	18	—	2 15	10 0	18 10	30
17	—	38 5	54 4	57 12	—	8 6	8 6	5 0	7 6	23 6	23 6	31
18	2 5	10 9	2 10	2 10	40 16	1 10	4 0	—	3 13	41 19	41 19	32
43 10	51 9	460 5	348 3	444 3	1956 18	48 2	72 9	31 17	67 6	1890 14	2019 6	

clubs generally insure any pig over nine or ten weeks old. If, instead of insuring co-operatively, the members were to insure their pigs individually with one of these companies for a sum which might in any case amount to £5, they would have to pay a premium of at least 5*s.* a year, which would not cover so many risks as are now covered by their average payments of 2*s.* 4*d.* per annum. It seems safe to say that no insurance company would, for less than 8*s.* per pig per annum, undertake the risks successfully undertaken by the Kemerton and Bredon Clubs at a cost to old members of 8*d.* a year. Such are the wonderful results of co-operation and care, and fair dealing among neighbours.

Many of the societies consist largely of working-men, who insure only one pig each. Such a man generally buys a young pig about ten weeks old in early spring, fattens it through the summer, and kills it in winter for consumption by himself and his family. The pig originally costs him from 10*s.* to £1, and its value gradually increases as it grows fatter, until at the time of slaughtering it may be worth £5 or more; and it is a great advantage to him to feel that, if his pig should die from disease or accident, he will get its full value at the time, or a large proportion of it, from his pig club. The low death-rate among pigs of this class is no doubt chiefly due to the fact that each pig is usually kept in a solitary sty, away from infection, under the eye of its owner and his wife, and is slaughtered while still in its lusty youth.

A new member joining a pig club generally pays an entrance fee of 1*s.*, sometimes increased to 2*s.* 6*d.* if he insures a sow or boar. He has also to pay the marker—who makes a cut in the pig's ear to signify its acceptance by the club as an insured pig—a fee which varies from 1*d.* to 3*d.* The annual premium for a store or fattening pig varies from 1*s.* to 6*s.* per annum, a fairly common rate being one penny per week, or 4*s.* 4*d.* per annum. A sow or boar pays a higher premium, varying from 2*s.* 6*d.* to 8*s.* 8*d.* per annum. As already said, the premiums realised during the year on 3,118 pigs of all classes averaged 1*s.* 11*d.* per animal insured. Most clubs have a rule that the members are liable to an extra levy, if at any time funds are required to meet claims; but none of the 31 clubs found it necessary to make such a levy during the year.

A few clubs have a rule to the effect that when the reserve fund gets above a certain amount, the surplus shall be divided among the members; and during the year the members of three clubs dissipated in this way £52 of the funds their predecessors had laboriously built up. But many clubs have adopted a wiser rule, which prescribes that so long as the fund remains above a fixed limit, all members of a certain standing shall cease to pay any premium, and it is under the operation of such a rule that clubs like those at Kemerton and Bredon now insure the pigs of all members of more than four years' standing for a total payment of *8d.* per annum to the management fund.

Some clubs bury the carcasses of diseased pigs: eleven clubs sold 43 carcasses at an average of £1 *2s.* each.

The affairs of each society are administered by a committee elected from among the members, and consisting largely of working-men. The number varies from 5 to 16, and is generally 10 or 11. The secretary is usually paid a small salary, and the marker often receives some remuneration from the club, besides the marking-fee he is paid by the owners of the pigs he marks. The rest of the work is done for nothing, and the total expenses of administration for all the societies probably do not average more than *6d.* per pig.

According to the experience of these 31 societies in different counties of England and Wales, it is possible for small holders and labourers in any healthy part of the country, by co-operation and mutual trust, to insure themselves against the loss of their pigs from disease or accident, by a total payment of something like *2s. 6d.* a year, which can be much reduced when the club has built up a substantial reserve fund.

KEMERTON AND OVERBURY PIG CLUB.

Kemerton in Gloucestershire and Overbury in Worcestershire are adjoining parishes of similar character. Between them they have a total acreage under crops and grass of nearly 5,000 acres, of which last year 3,000 acres were under permanent grass and 1,300 acres under corn crops. The country is good for fruit-growing, and the two parishes have

240 acres of orchard, which add a beauty to the landscape. Overbury especially must be one of the prettiest villages in England. The number of holdings above one acre is about 50, of which half are below 50 acres. In June, 1911, there were over 550 pigs, including about 75 breeding sows. The breed generally kept is a cross between the Yorkshire and the Berkshire, and store-pigs run up to about 16 score (320 lb.), the average weight of a cottager's fat pig when ready for killing being about 12 score, and its value about £5 or £6. One sow is said to have farrowed for twelve years, and presented her lucky owner with 246 pigs.

In 1887 the small pig-owners of these two parishes, following the good example set before them in the neighbouring parish of Bredon, formed a club "for the insurance and relief of each of the members who has the misfortune to lose a pig"; and had it registered as a "cattle insurance society" under the Friendly Societies Act. It now consists of eighty-six members, most of whom belong to the labouring class; but it also includes a baker, policeman, engine-driver, builder, glazier, blacksmith, and coachman. It insures 112 animals, of which six are breeding-sows and the rest "store-pigs," kept for fattening purposes. There is no limit to the number of pigs that a member may insure, but only three members insure three pigs each, and twenty two pigs each, the remaining sixty-three insuring only one pig each. Few of the pigs are kept to be sold, the insured pig's usual fate being to be slaughtered for the consumption of the owner's household before it is a year old. One working-man, who ordinarily keeps and fattens two pigs every year, when visited had a fine store of bacon, cured by his wife with hereditary skill, which he reckoned had cost him 5*d*. a lb. and was better than bacon he would otherwise have had to buy at 10*d*. a lb., or more.

A member on first insuring a store-pig pays 1*s*. "initiation," or entrance-fee, but is not entitled to any benefit for the first quarter. Thereafter he pays, at the rate of 1*d*. per week, 1*s*. 1*d*. every quarter as premium towards the insurance-fund, and 2*d*. per quarter to the fund for management expenses, making a total of 5*s*. a year. At the end of four years, during which he has paid to the club in all £1 1*s*., he becomes a "free member," is exempted from the payment of any further premium, and pays only 8*d*. a year to the management fund. In return for this small payment he remains permanently entitled to receive from the club the full value of his marked pig, at the rate of 10*s*. for every score of lb. it weighs, should it at any time die from disease or accident. Last year one member was paid £8 5*s*. from the club funds on the death of a single pig, estimated to weigh 16½ score, and his successive pigs, if marked as accepted, will remain insured on payment of 8*d*. a year.

For a breeding-sow or boar 2*s*. 6*d*. entrance-fee and 2*s*. 4*d*. per quarter is paid, and after four years, that is, after payment in all of £2, the owner's sow or boar, if marked, remains insured on payment of 8*d*. a year to the management fund.

How the club has secured this wonderful result may be understood from an examination of its history for the last ten years. On the average for that period it has insured annually ninety-seven animals, of which ninety-two were store-pigs and five were sows. The total number of deaths from disease or accident in the ten years has been nine, which gives an average death-rate of 0·9 per cent. per annum; in four years there were no deaths at all, and in the worst year there were two deaths among eighty-three pigs, which gives a death-rate for that year of 2·4 per cent. per annum. The total of claims paid in the ten years was £35 18*s*., which gives an average of £3 11*s*. 9*d*. per annum, of £4 per pig paid for, and of 9*d*. per annum per pig on the number of pigs insured. The actual contributions to the insurance fund, or premium income, averaged £4 17*s*. 1*d*. per annum, or 1*s*. per annum per pig insured, so that these contributions themselves more than covered the actual losses; but besides these there is a substantial income from interest on the reserve fund, which is deposited in the Savings Bank at 2½ per cent., and brought in an average income in interest of £3 11*s*. 5*d*. a year. There is no income from the sale of carcasses, as all pigs that die of disease are at once buried. The total income of the insurance fund averaged £9 6*s*. 8*d*. per annum, and as the claims paid averaged only £3 11*s*. 9*d*., there was an average annual profit of £5 14*s*. 11*d*.; and in the ten years the reserve fund mounted up from £120 to £177, at which it now stands. This gives an average reserve of £1 11*s*. per pig insured, and is enough in itself to pay the average losses of more than forty years.

The account of the costs of management is kept separate from the insurance account, and provided for by a separate levy of 2*d*. per quarter (8*d*. a year) on each member. The income from this source averaged £2 8*s*. 4*d*., and the total cost of management averaged only £2 2*s*. 6*d*. The only salaried official is the Secretary (the village postman), who now receives £1 5*s*. a year, and about £1 a year covers the other expenses for rent, printing, postage, &c. The Society is managed by a Committee of ten members, by two Trustees, a Treasurer, and two Presidents (one for each village), all elected at the general meeting, at which each member has a single vote on all questions that may arise. The most responsible duties are those of the Presidents, or markers, who have to pass as sound and mark all pigs presented for insurance, to inspect any pig that falls ill and see that the owner takes all possible steps for its recovery, and to value any pig that dies. The amount paid by the Club is the value of the pig at the time it fell ill, paid at the rate of 10*s*. per score of lb. weight of carcass. The weight is generally estimated by the eye, and accepted by the owner and the Committee. There is a provision in the rules for appointing arbitrators in case of dispute, but no occasion has recently arisen for calling for their services. The present Presidents are a pork-butcher and a labourer, and their only remuneration is 1½*d*., paid by the owner, for each pig they mark.

Briefly, then, the position which this club, mainly composed of working-men, has attained after twenty-five years, is that of its eighty-six members fifty-eight, who are of more than four years' standing, are now "free members," and have their pigs insured to their full value against death from disease or accident for a total payment of 8*d*. a year, and that the club has accumulated a reserve fund of £177, which is its own property. Its success is due to the healthiness of the locality; to the care with which the members look after their pigs; to the fairness and mutual trust which they show to each other; to the attention paid by the Committee-men and officials to the affairs of the club; to the good advice of their auditor, Mr. Hopkins, the schoolmaster of Overbury, who has helped

KEMERTON AND OVERBURY PIG CLUB.

Year.	Number of Members at the End of the Year.	Number of Pigs Insured at the End of the Year.	Number of Pigs on which Claims were Paid during the Year.	Rate of Mortality per cent. of all Pigs Insured.	INSURANCE FUND.														
					Amount of Claims Paid.			Premiums.			Interest.			Total Income of Insurance Fund.			Amount of Insurance Fund at End of Year.		
					£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1902	71	85	—	—		—		3	7	1	2	18	7	7	3	2	123	14	11
1903	70	83	2	2·4	6	10	0	2	18	3	3	1	6	6	17	10	124	7	5
1904	74	93	—	—		—		3	12	7	3	2	5	7	11	6	132	1	1
1905	83	104	—	—		—		4	3	7	3	0	0	8	7	3	137	12	6
1906	83	105	1	1·0	3	0	0	5	9	5	3	6	0	9	4	5	142	12	5
1907	86	97	1	1·0	1	12	6	4	18	0	3	13	1	9	2	4	155	3	3
1908	86	95	1	1·0	3	10	0	6	1	4	3	17	7	11	7	2	163	12	6
1909	81	96	—			—		5	1	6	4	2	8	9	15	9	173	8	3
1910	78	103	2	1·9	9	0	0	5	8	5	4	6	7	10	16	3	175	4	6
1911	86	112	2	1·8	12	5	0	7	10	7	4	5	6	13	1	4	176	18	3
Average for ten years	80	97	0·9	0·9	3	11	9	4	17	1	3	11	5	9	6	8			

them for a number of years to keep their accounts straight; and to the encouragement given to good sanitation by Sir Richard Martin, who offers an annual prize for the best-kept sty, and insists on proper drainage. Some pig clubs have foolishly dissipated a portion of the reserve fund they had laboriously built up by distributing it among their members. The Kemerton and Overbury Club more wisely made a rule that when the fund should amount to £60, all members of four years' standing should be exempted from premium subscriptions until the fund fell to £30. This has been done, and still the reserve fund continues to grow. To judge from the experience of the last ten years, the club might safely reduce its charges to members still further. It might, for instance, utilise the interest from the reserve fund to pay the costs of management, cease the levy of any contribution for the management fund, charge to old members only a nominal premium of 4*d*. per pig per annum, and to new members for four years 4*s*. per pig per annum, and pay the marker from club funds 2*d*. for every pig he is called in to mark, whether he marks it or not, and 1*s*. for every pig he has to attend when it falls ill, whether it recovers or dies. So long as the reserve fund remains above £100 it would seem safe to make these concessions. Should it fall below that amount, or, say, below £1 per pig insured, they would have to be reconsidered, as it is essential to maintain a good reserve fund to secure the members from the risk of having to make a special levy on themselves to meet any losses that may exceed in amount the funds available.

Spurrey as a Forage Crop on Sandy Soils.

The Board have received the following note from Mr. Henry W. Wolff with regard to the information as to the cultivation of spurrey as a forage crop, and for use on sandy soils, which appeared in this *Journal* for March, 1912, p. 1021:—

"I do not believe that spurrey has much of a future in this country; we have not much of the soil for which it is "indicated," and on such soil we may, with our generally moist climate, grow more useful fodder plants.

"The peculiar merits of spurrey are (1) that, having a short period of vegetation, it will come in conveniently as a catch crop after corn, for which purpose, however, our wheat crops ripen rather late; abroad it is grown after rye, which matures earlier; and (2) that it will grow on very poor soil, where—before lupins and serradella were brought upon the scene—there were no other fodder crops to be raised.

"It is quite true that spurrey provides a highly nutritious fodder, rich in nitrogenous constituents. It is almost too precious to be given to animals other than milch cows, the yield and quality of the milk of which it distinctly improves. I believe that other animals do not care for it. At any rate, I have never seen my sheep take a surreptitious bite at it, though they have had many an opportunity. Its yield is small, however, more particularly if it be of the short variety. The 'ordinary' or short variety must be pulled, root and all, but the 'giant' variety will stand cutting, which is generally done with the sickle.

"I have never seen spurrey ploughed in, and it has never occurred to me to carry out this operation. For ploughing in on sandy soil there is an excellent plant, the yellow lupin, which directly enriches the soil, and shading it well, leaves it in good condition. Being a leguminous crop, it absorbs nitrogen from the atmosphere, and it is probable that its long roots draw up mineral food. The drawback to the yellow lupin as a forage crop is that only sheep will eat it. On sandy soil abroad, I have also done very much better with serradella than with spurrey. Serradella enriches the soil in the same way as lupins, and leaves it in good condition. It yields an abundant crop of fodder, which may be pastured off, or fed green, or made into hay, and is eaten by animals of all kinds. I have grown large quantities of it, either as a rotation crop, sown by itself, or as an aftercrop to corn, in which case it is sown in the corn in the spring."

Destruction of Water Weeds.

In considering the question of the eradication of water-weeds from ponds, it is necessary to draw a distinction between the larger weeds, such as American Water Weed, Water Crowfoot, Duck-weed, &c., and the smaller algæ.

The larger weeds are not only the most obnoxious, but are also the most difficult to eradicate, as they can only be kept down by cutting and dragging them out. In small shallow ponds this may be done by men wading in the water and using hand-scythes; or scythe-blades may be attached to ropes, which can be dragged through the weeds from a boat or from opposite banks of the pond. Special weed-cutting saws are also made for this purpose, and several other devices exist for use in large stretches of water. Some of these contrivances are of considerable size, and are very costly.

The smaller algæ are visible chiefly as a green or brown scum, and are commonly seen during the summer and autumn on still or nearly still water.* These troublesome growths not only frequently destroy the beauty of ponds entirely for a time, but also have an offensive smell. For the destruction of these small, slimy weeds, copper sulphate has proved to be very effective, especially in fresh water. This material has been used with success in recent years both for the smaller ponds at Kew Gardens and for the ornamental water in St. James's Park. Previous to the last two summers, it had been a costly and troublesome matter in the latter case to keep the water presentable in hot weather, men in boats being employed to remove the weed with rakes, &c. As a result of the adoption of the copper sulphate treatment, however, the lake can now be kept practically free from weed at a much less expenditure in money and labour than formerly.

It must, however, be borne in mind that copper sulphate should only be applied with the greatest caution to ponds containing fish, some of which appear to be rather sensitive to copper sulphate. There is at the present time no detailed information as to the resisting power of English fish, and in the absence of such information it would not be advisable to treat any fish pond in this country, even with a very dilute solution, such as 1 part in 5,000,000, without first determining by experiments with one or two fish in a few gallons of water, the susceptibility of each species. It is, however, somewhat reassuring in this connection to learn that copper sulphate applied during the last two summers to the water in St. James's Park was found to be not only harmless, but even beneficial to the fish. In former years many had been found to be badly attacked by a fungus, but at the last cleaning out the fish were found to be quite free from the fungus disease, and remarkably clean and silvery.

---

* A note on the eradication of algæ from water-cress beds by means of copper sulphate appeared in this *Journal* for March, 1911, p. 988.

If there are no fish in the pond, 1 part (by weight) in 1,000,000 (or 1 lb. of copper sulphate to 100,000 gallons of water) may be applied without rendering the water dangerous for drinking purposes.

Ordinary commercial copper sulphate should be used, and, in standing water, may be easily applied, the only important point being that the copper sulphate must be thoroughly and rapidly distributed throughout the pond. In small ponds, the copper sulphate, broken small, and enclosed in a bag of loose texture, may be tied to the end of a pole and drawn backwards and forwards through the water. In large ponds the bag should be towed behind a boat, which should be rowed to and fro in parallel paths not more than from 10 to 20 feet apart. In water with a temperature of about 60° Fahr., something like 100 lb. of copper sulphate can be so distributed in an hour. The effectiveness of the treatment is found to depend to some extent on the temperature of the water, and, if this should be much below 60° Fahr., or if the water is very hard, or contains much organic matter, more copper sulphate should be used. It is found that copper sulphate rapidly disappears from water to which it has been applied, presumably because it combines with the algæ which it destroys. Copper sulphate has also proved effective when applied to the surface of the slime in the form of a spray composed of 1½ oz. of copper sulphate dissolved in 2 gallons of water; but if water-lilies are present they may be injured by this method of treatment.

It is necessary to calculate the amount of water in a pond in order to determine the amount of copper sulphate which may safely be applied, and this may be done with sufficient accuracy by multiplying together the average length, breadth, and depth of the pond in feet, and multiplying the result by 6¼, the approximate number of gallons in a cubic foot.

Eradication of Foot-and-Mouth Disease.

The Departmental Committee appointed by the President of the Board of Agriculture and Fisheries in November, 1911, to inquire into the circumstances of the outbreaks of foot-and-mouth disease during 1911 and to consider whether any further measures can be adopted to prevent their recurrence, have recently issued their Report (Cd. 6,222, price 1½*d.*).

It appears that the disease has been present in Great Britain in ten years only out of the twenty-one years between 1892 and the present time, the total number of outbreaks in that period being 158; but as 133 of these outbreaks occurred during the first ten years, and only 25 during the last 11 years of the period, it would seem that the disease is more under control now than formerly.

Research into Foot-and Mouth and other Diseases.—There is but little exact knowledge, even among the greatest veterinary experts, as to the nature, origin, and means of transmission of this disease; the Committee feel, therefore, that it is most important to obtain further information on the subject through the medium of special and thorough investigation, experiment, and research. They consequently welcome the appointment of a scientific committee to study it in India, and are of opinion that a liberal grant from the Treasury should be asked for, in order that the inquiry should not be hampered for want of funds or by any limitation of time.

The advisability of establishing an experimental station for foot-and-mouth disease in this country, or on an adjacent island, has been considered by the Committee. They, however, cannot approve of this proposal. Whatever precautions were taken the Committee would be opposed to the maintenance here of a permanently infected centre with such a highly infectious and contagious disease, involving a source of danger to the stock of this country. The Committee, however, suggest that mutual benefit might result from the establishment elsewhere of an international experimental station fully equipped for research in diseases of animals, and they strongly recommend that Continental, and possibly other, countries should be approached with a view to co-operation in this matter.

Importation of the Virus.—The Committee state that it may fairly be assumed that the virus causing outbreaks in Great Britain has been imported by mediate contagion, but they recognise that it is impracticable, even if it is not impossible, to erect an impregnable barrier against the introduction of disease. It is agreed, however, that the risk is greater with certain articles, those most open to suspicion being—(*a*) Hay and straw; (*b*) milk and milk products; (*c*) hides and skins, heads and feet, carcasses of calves in skins, vaccine seed lymph; (*d*) hoofs, horns, bones and other animal offals; (*e*) persons and their clothing.

Various recommendations are made by the Committee to prevent the introduction of the virus of the disease in any of these ways.

With regard to the importation of hides and skins, international action in various directions is suggested, and in this connection the Committee draw attention to the fact that an international veterinary congress is to be held in Great Britain in 1914, and they urge that the subject of foot-and-mouth disease should there receive serious consideration, especially with a view to the Governments of infected European countries taking joint action to endeavour to stamp out the disease on the Continent. It is hoped that the information which will be obtained through the scientific inquiry about to take place in India will be then available, and form a valuable addition to the stock of knowledge for the discussion of this disease, which is creating great havoc among the flocks and herds of the world.

Appointment of Veterinary Inspectors.—The Committee also considered the methods of appointment and qualifications of veterinary inspectors under the Diseases of Animals Acts, and emphasise the importance of post-graduate training for the veterinary profession. They also recommend that the appointment of all veterinary inspectors of local authorities should be in accordance with uniform rules relating to qualifications to be laid down by the Board of Agriculture and Fisheries, and that arrangements should, if possible, be made, whereby every local authority or group of local authorities under the Diseases of Animals Acts should have at their disposal the services of a chief veterinary officer with special qualifications in veterinary science and practice.

This officer should be recognised as the chief veterinary officer for the administrative area for which he is appointed, and should not be in private practice, but should devote his whole time to work under the Diseases of Animals Acts. It is suggested that his duties should include inspecting, directing, and reporting on the work done by the ordinary veterinary inspectors of the district, making veterinary examinations and reports to the Board of Agriculture and Fisheries on reported outbreaks of swine fever and other diseases, and be available by the Board for organising and carrying out protective measures on the outbreak of any epizootic diseases.

The Committee place on record their approval of the procedure adopted by the Board of Agriculture and Fisheries in dealing with outbreaks of the disease.

The Administration of the Small Holdings Act in 1911.

The following account of the work accomplished during 1911 under the Small Holdings Act of 1908 is given in Part I. of the Report of the Land Division of the Board (Cd. 6,157, price 5½*d.*).

Up to the 31st December last 124,502 acres had been actually acquired or agreed to be acquired for small holdings by County Councils in England and Wales, of which 78,871 acres had been purchased for £2,493,121, and 45,631 acres leased for rents amounting to £55,637. Of this land 94,154 acres had been actually let to 6,916 individual small holders and 186 acres sold to 13 small holders. In addition 4,597 acres had been let to 39 Co-operative Small Holdings Associations, who had sublet the land to 732 of their members, and 2,644 applicants had been provided with over 32,000 acres by private landowners direct, mainly through the instrumentality of the Councils. The land that has been acquired, but which is not yet let in small holdings, will probably provide for another 2,000 applicants, and the Councils of County Boroughs have acquired 1,303 acres which are let to 161 individual small holders and 63 members of Cŏ-operative Associations. It appears therefore that the Act has resulted in the provision of land for 12,529 applicants in four years.

Applications.—During 1911, fresh applications were received by County Councils from 4,301 individuals and 27 Associations. In the four years since the Act came into operation, applications have been received from 35,187 individuals and 61 Associations, and the total quantity of land applied for amounts to 584,802 acres. Of the applicants who applied during 1911, 2,544 individuals and 16 Associations have been provisionally approved as suitable for a total quantity of 43,338 acres.

The proportion of applicants who express any desire to purchase holdings still remains very low, being only 2·12 per cent. of the total number of applicants who expressed a definite preference on the subject.

Of the applicants approved during 1911, 686 or 27 per cent. asked for houses to be provided on their holdings.

Acquisition of Land.—The quantity of land acquired or agreed to be acquired by County Councils during 1911 was 36,358 acres, of which 25,994 acres were purchased for £848,845, and 10,363 acres were leased for rents amounting to £11,861. These figures show an increase of 3,000 acres over the quantity acquired during 1910.

During 1911, the quantity of land purchased was 5,000 acres more than in 1910, and the quantity leased was 2,000 acres less, and it is especially satisfactory to note that there is a much greater disposition on the part of Councils to purchase land rather than to lease it. In the case of land leased for small holdings, any expenditure on equipment and adaptation must necessarily be recouped within the term of the lease, with the result that the rents which must be charged for the holdings are considerably higher than would be required if the land had been purchased. A loan for a period of 14 years involves annual charges for repayment at the rate of 9½ per cent., and for 21 years it is nearly 7 per cent., whereas on land which has been purchased, houses and buildings can be provided at a charge of 4½ per cent. on the outlay. The average price of the land purchased in 1911 was £32 13*s*. 0*d*. an acre, and the average rent of the land leased £1 2*s*. 11*d*. an acre.

The total quantity of land acquired by County Councils since the Act came into operation is 124,502 acres, of which 78,871 acres have been purchased for £2,493,121, and 45,631 acres have been leased for rents amounting to £55,637. The average price of the land purchased was £31 7*s*. 0*d*. an acre, and the average rent of the land leased was £1 4*s*. 4*d*. an acre.

Small Holdings Provided.—The number of small holdings provided by County Councils, of which the holders were in actual possession on 31st December, 1911, was 6,929. This does not include the 732 holdings on land let by County Councils to Associations.

In addition to the holdings provided by County Councils, the returns made to the Board show that, during 1911, 330 applicants were provided with holdings amounting to over 5,000 acres by private landowners direct, mainly through the instrumentality of the Councils.

Condition of Holdings.—Inquiries have been made from County Councils whether they are satisfied with the cultivation of the small holdings they have established, and whether the rents have been punctually paid, and the replies received are on the whole extremely satisfactory. The severe drought in the summer proved a great handicap to many of the small holders on the lighter lands and in the grazing and dairying districts, but in spite of this the rents as a rule have been punctually paid, and there have been very few failures. The small holdings on the fen land in the Eastern Counties, however, have gained rather than lost by the dry weather, and many of the tenants there have done particularly well, and have had a very profitable year. In most counties the holdings are inspected at least once a year on behalf of the Councils, and it is very rarely that any unfavourable report is made on their cultivation, while, in the majority of cases, it appears that the land has been improved since it has been converted into small holdings. During the past year, 99 tenants in England and Wales have given up their holdings at their own request, and 20 tenants have received notice to quit from the Councils. This shows that the proportion of unsatisfactory tenants is less than one-half per cent. In the counties of Cambridge, Isle of Ely, Hunts, Lindsey, and Holland, with a total rent roll of £26,170, the arrears at the end of 1911 only amounted to £110, or less than one-half per cent., and it is likely that practically all these arrears have been received by the present time. This is a record which probably has been equalled by few, if any, private estates in the country. Though the counties mentioned above are among those which have suffered least from the drought, the results in other parts of the country are, on the whole, no less satisfactory. In Bucks, Cheshire, Warwick, and the East and North Ridings there were no arrears, in Norfolk they were only £6, in Northampton £8, and in Somerset, with a rent roll of £9,533, a sum of £148 was unpaid at the end of the year, of which £72 has since been received, and of the remainder very little, if any, is expected to rank as a bad debt. In Wales there are no arrears in seven out of the twelve counties.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

FIELD CROPS.

Growth of Linseed (*Essex Educ. Com., Co. Laboratories, Chelmsford, Rept. on Field Expts.*, 1911).—Linseed was sown in 1911, at the rate of six pecks an acre on a small plot of ground which had been dunged at the rate of 7 tons per acre during the winter. The crop grew luxuriantly, notwithstanding the drought, and gave a yield of 10 cwt. of seed per acre. The seed, judged by its analysis, was the best sample ever tested at the laboratories, and contained 35·66 per cent. of fat, and 27·47 per cent. of albuminoids.

Influence of Weather on Barley, Potatoes, and Sugar Beet (*Landw. Jahrb., Band xli., Heft.* 3–4, *abstracted in Bull. Bur. Agric. Int. and Plant Diseases, March,* 1912).—The following conclusions are reached with regard to the influence of the weather on *barley* in Prussia:—The weather during the last few weeks before ripening exerts a decisive effect on the quality of malting barley. A dry or not very wet July is favourable, excessive rain or excessive drought unfavourable. Moderate moisture, even less than the normal, accompanied by a rather low temperature, leads to a good crop of high quality. Low temperatures and a small amount of sunshine are not incompatible with the production of a good malting barley; it is even affirmed that cold in June and July has a beneficial effect as regards both quality and yield. The bad effects of excessive rainfall in July are much mitigated when the weather at the same time remains cold and overcast. The time of sowing does not appear to exert any specific effect on the quality of the barley.

---

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

In the case of *potatoes* excessively wet weather always influences the quality of potatoes unfavourably, especially at flowering, when the tubers are developing. Too dry weather reduces the quality as well as the yield. Much rain after a dry period injures the quality, while drought after abundant rains unfavourably affects the weight of crop. Changeable, cold and rainy weather, during the second period of growth (in July for medium and late varieties) does not seem to have any disadvantageous effects. If other factors are favourable, low temperatures do not injure quality. Hot, wet weather results in the production of tubers of low quality.

With regard to *sugar beet*, it is concluded from a large number of experiments that if the rainfall is moderate from May to the middle of June, abundant from the middle of June to the beginning of August, moderate in the latter part of August, and low in September and October, a good quality crop will be produced. Sufficient rainfall from June to the beginning of August is indispensable for a good crop. In some measure it fosters an earlier growth and prevents this growth taking place in the autumn, at a time when the crop should be ripening. Dry weather in August and September (up to the end of the vegetative period), or in September and October (till harvest) improves the quality of the crop. Wet weather before ripening or lifting, following on a dry, hot, and sunny season, lowers the quality of the crop; a wet summer has the same effect. Excessive rains in August and September, or in September and October, or even in October alone, are always injurious to quality. Sunlight and temperature have only a very restricted influence on the crop.

SOILS AND MANURES.

Manuring of Mangolds (*Essex Educ. Com., Co. Laboratories, Chelmsford, Rept. on Field Expts.*, 1911).—An experiment designed to give information as to what artificial manures would be most profitable as a supplement to farmyard manure for mangolds was conducted at three centres in Hertfordshire in 1911.

The dressing of farmyard manure used on all the plots was one of 15 tons per acre. The results at the different centres varied a little, but, generally speaking, it may be said that a complete mixture of artificials gave the best and most profitable results. There was little difference between the results obtained by giving all the nitrogen in the form of nitrate of soda and those produced by giving half of it in the form of sulphate of ammonia. Except at one centre on application of kainit at the rate of 3 cwt. per acre appeared to supply all the salt required by the crop. Basic slag gave as good results as superphosphate when applied at rates corrresponding to equal money values per acre.

Manuring of Mangolds (*Univ. Coll. of N. Wales, Bull. vii.,* 1911).—During the last three years a comprehensive experiment on the manuring of mangolds has been carried out at several centres in the four counties of North Wales. The plan of the experiment, the cost of artificial manures per acre in 1911 and the average weights of roots obtained in the three years are given below:—

Plot.	Manure per acre.	Cost of Artificial Manure per acre, 1911.	Average Weight of Roots per acre.					
			1911.		1910.		1909.	
		£ s. d.	tons	cwt.	tons	cwt.	tons	cwt.
I.	No manure	—	8	5	7	18	10	9
II.	10 tons farmyard manure ..	—	21	3	18	2	22	17
III.	20 ,, ,, ,, ...	-	24	9	20	19	27	10
IV.	10 tons farmyard manure ... 256 lb. nitrate of soda ... ... 698 ,, superphosphate ... ... 164 ,, sulphate of potash ...	2 14 9	26	11	22	18	30	4
V.	20 tons farmyard manure ... 256 lb. nitrate of soda ... ... 698 ,, superphosphate ... ... 164 ,, sulphate of potash ...	2 14 9	30	11	25	14	32	3
VI.	20 tons farmyard manure ... 202 lb. sulphate of ammonia... 698 ,, superphosphate ... ... 164 ,, sulphate of potash ...	2 19 4	26	19	22	16	30	15
VII.	10 tons farmyard manure ... 128 lb. nitrate of soda ... ... 349 ,, superphosphate ... ... 82 ,, sulphate of potash ...	1 7 5	26	3	20	6	27	3
VIII.	20 tons farmyard manure ... 128 lb. nitrate of soda ... ... 349 ,, superphosphate ... ... 82 ,, sulphate of potash ...	1 7 5	26	9	21	8	28	18

It will be noted that in every year plot V. gave the heaviest crop, though whether it can be regarded as the most profitable one depends on what is taken as the value of a ton of mangolds and of a ton of farmyard manure. In most cases the results obtained on plot IV. would be considered more satisfactory, and it is interesting to note that even in the case of mangolds, which are generally supposed to be able to make profitable use of large quantities of farmyard manure, the doubling of a dressing of 10 tons per acre has only resulted in an increase of about 3 tons an acre in the crop. Nitrate of soda has consistently given much better results than sulphate of ammonia when used in quantities such that each supplied the same weight of nitrogen per acre.

Manuring of Potatoes (*Univ. Coll. of N. Wales, Bull vi.*, 1911). —This experiment has been carried out in North Wales for the last four years at twenty-five centres in all, and, as the table given below shows, with remarkably consistent results in the different years:—

Plot.	Manure per acre.	Cost of Artificial Manure per acre in 1911.			Average Weight of Marketable Potatoes per acre.							
					1911.		1910.		1909.		1908.	
		£	s.	d.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
I.	No manure		—		5	15	3	1	4	7	4	20
II.	20 tons farmyard manure...		—		11	13	7	2	8	15	8	16
III.	10 tons farmyard manure...		—		10	13	6	1	7	14	7	10
IV.	10 tons farmyard manure... 202 lb. sulphate of ammonia 524 ,, superphosphate ... 164 ,, sulphate of potash...	2	15	5	12	15	8	5	9	18	10	9
V.	10 tons farmyard manure 101 lb. sulphate of ammonia 262 ,, superphosphate ... 82 ,, sulphate of potash...	1	7	9	11	14	7	5	9	6	9	3
VI.	10 tons farmyard manure 101 lb. sulphate of ammonia 262 ,, superphosphate ...	0	19	10	11	10	7	7	9	4	8	8
VII.	10 tons farmyard manure 101 lb. sulphate of ammonia 82 ,, sulphate of potash...	1	1	11	11	3	6	18	8	13	8	15
VIII.	10 tons farmyard manure 262 lb. superphosphate ... 82 ,, sulphate of potash	0	13	9	11	8	6	19	9	0	8	9
IX.	202 lb. sulphate of ammonia 524 ,, superphosphate ... 164 ,, sulphate of potash	2	15	5	11	9	7	1	8	18	8	11

A consideration of the results shows the inadvisability of relying solely on farmyard manure in growing potatoes. When used to supplement 10 tons of dung per acre, the half-dressing of artificial manures, costing, in 1911, 27*s.* 9*d.* per acre, gave an average increase in crop of about 28 cwt. per acre, and a comparison of the results obtained on plots IV. and V. shows that even the full dressing given on plot IV. was not above the limit of economical manuring; on an average the extra quantity of artificial manure produced about a ton more marketable potatoes at a cost of 27*s.* 9*d.*

A comparison of the crops on plots V., VI., VII., and VIII. suggests that in most cases a "complete" mixture of artificial manures is required for potatoes. The plots receiving artificial manures only have in every year given highly satisfactory returns.

Effect of Sawdust on Plants (*Maryland Agricultural Experiment Station, Bull.* 158).—There is in this country a general belief among farmers and gardeners that farmyard or stable manure made with sawdust as litter is injurious to plants, or at least is not so valuable as that made with straw. This belief is apparently also widespread among gardeners in America, and in order to ascertain if there is any real foundation for it, experiments were begun in 1908, and continued on a large scale for three years with flowering plants grown in greenhouses. Comparisons were made between (1) cow manure made with sawdust as litter; (2) cow manure made with straw or chopped maize stalks as litter; (3) cow manure free from litter of any kind, the cows being kept on a cement floor without bedding.

The manure was collected and left in a heap until some fermentation had taken place. This broke down the strawy litter considerably, but the sawdust had quite a fresh appearance when it was applied. The same amounts of the different manures were used, and they were all thoroughly worked into the soil. The plants tested were roses, carnations, chrysanthemums, and sweet peas. In no case could any harmful effect of the sawdust be detected, and, in fact, taking the average of the three years the manure containing it gave slightly the largest number of blooms. For other reasons, however, it was concluded that for the particular circumstances manure without litter of any kind was the best.

Top-dressing Pastures (*Trans. Highland and Agric. Soc. of Scotland,* 1912; *Dr. R. Shirra Gibb*).—Experiments conducted by the Highland and Agricultural Society in co-operation with the three Scottish Agricultural Colleges were begun in 1909, with the object of ascertaining why the effects of applications of basic slag should vary so much in different cases. The intention was that in each district the college staff should select three centres having soils differing as much as possible. This was not exactly carried out, but seven centres in all were fixed on. The manures were applied early in 1909, and the plots have been inspected every summer. The results obtained vary at the different centres, and no definite conclusions can be drawn from the results up to the present, but the experiment suggests:—(1) That there are probably few worn-out pastures that do not benefit by the application of phosphatic manures; (2) that Algerian phosphate, if finely ground, is not much inferior to basic slag; (3) that potash in any form should be carefully experimented with before much expense is incurred in applying it to old grass land; (4) that ground lime applied at the rate of a ton per acre is not much good as a surface dressing.

Experiments with Catalytic Manures (*Ann. Sci. Agron., March,* 1912).—The results of pot-culture experiments described in this publication tend to show that the yields of certain crops can be effectively increased by the use of very small quantities of catalytic substances. The effect of the different materials tried varied according to the crop. Those which had most effect on *carrots* were (in order of value) sulphur, sulphate of ammonia, sulphate of manganese, and silicate of soda. Sulphate of iron seemed to have no effect. As regards *potatoes,* sulphate of alumina, silicate of soda, sulphate of iron, sulphur, and manganese salts all increased the yield. Sulphate of alumina, sulphate of iron, and sulphur produced a slight increase when tried with *onions*, and sulphate of uranium produced a very considerable effect on *beets*.

The Inoculation of Red Clover (*Devon Co. Agric. Com., Rept. on Field Experiments*, 1910 *and* 1911).—Many experiments have been tried in this and other countries to test the possibility of increasing the number of nodules on the roots of leguminous plants, thus causing a greater assimilation of nitrogen and a more vigorous growth of the plant, by the application of pure cultures of the special organisms responsible for the nodule formation. In 1909 cultures were obtained from the Rothamsted Experimental Station, and used to inoculate red clover seed immediately before sowing. Three centres in Devonshire were selected, the conditions being widely different. At one centre inoculation appeared to produce at first a more vigorous crop, and at another the crop of hay was slightly greater, but the differences were so small that it cannot be said that the inoculated seed gave really better results than the uninoculated.

Mineral Substances in Forest Soils (*Int. Mitt. für Bodenkunde, Band I.*, 1912, *Heft* 6).—The contention of Schütze that the amount of mineral substances in forest soils is an all-important factor determining the yield of timber was not confirmed in these experiments, carried out on a sandy soil at Melchow, near Eberswalde. Good yields of Scotch pine were obtained, although the soil was poor in mineral substances, and it is stated that, although the importance of such substances must not be underestimated, a large quantity is not essential. On the other hand, the results of these experiments are taken as showing that the amounts of nitrogen and humus in the soil are the real determining factors.

LIVE STOCK

The Rate of Evolution of Hydrocyanic Acid from Linseed under Digestive Conditions (*Proceedings of the University of Durham Philosophical Soc., Vol. iv., Part* 3; *S. H. Collins*).—It is fairly generally known that linseed, and occasionally linseed cakes, foods which are rightly regarded by farmers as among the safest of feeding stuffs, readily give off prussic acid on being moistened (*e.g.*, see *Journal*, February, 1911, p. 904). It is often assumed that in the case of the cake the generally harmless character is due to the fact that the enzyme responsible for the liberation of the poison is rendered inactive by the heat used in the process of pressing out the oil. The investigations reported on show, however, that the generally innocuous character, not only of the cake, but of linseed, must often be due to the acidity of the stomach and to the presence of substances, such as sugar and cellulose, in the alimentary canal of the animal consuming the food. It is also pointed out that, even if prussic acid is produced in the alimentary canal of an animal, the rate of production to a very great extent determines its effect. If it is produced slowly enough the animal removes it as it is formed. The rates of evolution from various samples of linseed and linseed cake under different conditions are given.

Prussic acid poisoning, as a result of feeding on linseed, would only be likely to occur in an animal suffering from indigestion of such a peculiar character that the food was not rendered acid—a very rare occurrence.

Horse Poisoning by "Equisetum Arvense, L." (the Common Horsetail) (*Roy. Bot. Gardens, Kew, Bull. of Misc. Information, No.* 3, 1912).—Several cases of horse poisoning in which *Equisetum arvense* was the suspected plant having been submitted to Kew during 1910, a note is made of some experiments carried out in Nebraska, the results of which were published in the nineteenth annual report of the Agricultural Experiment Station, Nebraska. Two horses were experimented on, no grain was given, and the amount of dried *Equisetum* mixed with the hay was gradually increased from half a pound to six pounds a day. At first the animals seemed to prefer the *Equisetum* to the rest of the hay, but after a few days showed an aversion to it, which increased, till near the end the greatest difficulty was experienced in getting the animals to touch it. About the fourteenth day the animals began to show a hesitating, staggering gait, loss of muscular control, poor condition of flesh, and an unusual sensitiveness of the shoulder, these being accompanied by a temperature normal or below the normal, and a good appetite. The diuretic properties of the plant were shown by the constant saturation of the ground with urine, which was persistently alkaline.

It was concluded that the weed must be present in large quantities to be dangerous to horses, but that when taken in sufficient quantities it is fatal to these animals.

DAIRYING.

Variation in the Composition of Cow's Milk with Advance of Lactation (*Univ. of Leeds and Yorks Co. for Agric. Educ., Bull.* 84).—In the last few years a large amount of experimental work has been carried out to ascertain the influence of various factors upon the amount and quality of milk yielded by cows, and incidentally it has been clearly demonstrated that there is great variation in the composition of milk produced under ordinary conditions. Very little reliable information is, however, available as to the general trend of the changes in the composition of cow's milk throughout the whole course of lactation. A summary is therefore given of the information obtained on this point during three years from fortnightly tests of the milk of each cow in the herd at the Experimental Farm at Garforth. The records for the three years include seventy completed periods of lactation, of which fifty-seven have been utilised.

Variation in Yield of Milk.—Taking the averages of all the cows, the calvings of which were spread over the whole year, the records show a slight rise during the first few weeks followed by a steady and fairly regular fall. The average reached its maximum about the end of the first month, but in some cases the yield tended to rise for much longer than this—in one case for fully twelve weeks. The time of year at which the cows calved was found to have a considerable influence on the rate of decline in the milk yield. In the case of cows calving in the period from December to February the yield fell steadily, but not rapidly, until about April, then remained fairly constant throughout May and June, after which it fell steadily again. The latter part of June or the beginning of July was the critical period also in the case of cows calving in the period from March to

June. In the case of July calvers the yield fell steadily right through the lactation until in the May of the following year they were on pasture once more. Cows calving in the months August to November showed a fairly rapid drop to about an average yield, which was then surprisingly well maintained until in the following July the deficiencies of pasturage began to produce their effects.

Taking the averages of the whole period the calvings that fell in the months December to February proved the most profitable in milk yield, and April calvings the least profitable. Of the thirteen lactations commencing in April not one lasted more than thirty-six weeks.

Variation in Percentage of Fat.—In most cases the percentage of fat fell somewhat rapidly during the first month or six weeks, then remained fairly constant up to the fourth or fifth month, after which a steady rise set in, which in some cases was greatly accentuated during the last week or two of lactation. In only one case did the percentage of fat fall steadily throughout the later stages of lactation. The average percentage of fat was lowest in the fourth month after calving.

An analysis of the records showed considerable variation according to the time of year at which the cows calved. Winter calvers reached the lowest point in the fifth month; in the case of March calvers it was reached in the third month, and in the case of April calvers in the second month. In all these cases the worst time corresponded roughly with the first half of the pasturage season. Summer calvers (May to September) differed from the others in that there was not so pronounced a change in the percentage of fat at any period—the range in the monthly averages being only from 3·82 to 4·25 per cent. As far as general conclusions can be drawn from the number of lactations investigated, it appears that the percentage of fat will generally be lowest in the first part of the pasturage season, except in the case of cows which are far advanced in lactation when turned out in spring.

Variation in Percentage of Solids-not-Fat.—With regard to solids-not-fat, the records of individual cows show considerable differences, which is not surprising in view of the variety of substances included in the term. During the earlier stages of lactation the variations in solids-not-fat were similar to those observed in the case of fat, the average tending to fall during the first two months and then remaining fairly steady for three or four months. After this, however, the tendency was for the percentage of solids-not-fat to fall, though there was perhaps a slight rise during the last two months.

The fall in the percentage of solids-not-fat during the second half of the period of lactation was chiefly due to the steady decrease in the amount of sugar after the first month or so; the variation in the proportion of albuminoids is precisely similar to that in the amount of fat, while the ash remains remarkably constant throughout the whole period.

Soy Bean Cake for Dairy Cows (*Ann. Sci. Agron., February,* 1912). —Extensive experiments with a large number of cows have been carried out in Denmark with regard to the effect of soy bean cake on the yield and fat content of the milk of dairy cows and on the quality of the butter.

In its influence on the yield and fat content of milk the soy bean cake was found to be in no way superior to the mixture of other concentrated foods against which it was tested, viz., decorticated cotton cake, earth nut cake, and sunflower seed cake. As regards the quality of the butter, the soy bean cake had no effect on the aroma and flavour, but produced butter of a firmer consistency than the other cakes tried. It is concluded that soy bean cake may be added with advantage to a mixture of such concentrated foods as produce a soft butter, but that beets should not be given in too large quantities along with soy bean cake, as the former also produce hard butter.

MISCELLANEOUS.

The Food of Birds (*Trans. Highland and Agric. Soc. of Scotland, 1912; Miss Laura Florence*).—In this article an interim report of investigations into the food of birds is given, and the nature of the food found in the alimentary canals of 616 birds, the majority of which were shot in the north-eastern counties of Scotland, is described. Specimens of seventy-three different species of birds were examined. The work is being continued, and no attempt is made at this stage to draw definite conclusions or to make general statements as to the proportion of the different kinds of food preferred by the various birds. It is interesting to note that among the Dipterous insects found in the birds, daddy-longlegs and their larvæ were most frequent, and during August large numbers of eggs of these insects were noticed. There appeared to be no outward difference between eggs found in the stomach and those in the cloaca. Whether the vitality is affected or not by their passage through the bird is a point that is to be tested.

Effect of Ripeness and Water Content of Seeds on Germinating Capacity (*Mitt. der Deut. Landw. Gesell., March 9th,* 1912).—Dorph Petersen's experiments in 1911 at the Copenhagen Seed Control Station showed that both the degree of ripeness of seeds and their content of water have an important influence on their germinating capacity. It was shown that the germinating capacity. of seeds of cocksfoot and Italian ryegrass increased with ripeness until the "late-green" stage of ripeness was reached, but that as the seeds become yellower the germinating capacity decreased.

A rapid decrease in germinating capacity occurred on keeping seeds of mangolds with a high water content (27 to 43 per cent. of water), and it is considered that if seeds are to be kept for some length of time they should contain not more than the following amounts of water:—Mangolds, 13 to 15 per cent.; grasses, 10 to 11 per cent.; clover, 8 to 9 per cent.; cabbages and turnips, 7 to 8 per cent.

Longevity of Seeds (*Roy. Bot. Gard., Kew, Bull. Misc. Information, No.* 2, 1912).—An account is given of a case where seeds of a leguminous plant, *Albizzia Lophantha,* have germinated and given flowering plants after having been preserved in a packet for sixty-eight years.

Influence of Light and Temperature on the Germination of Seeds (*Praktische Blätter für Pflanzenbau und -schutz*).—In this paper the influence of some factors on germination is discussed, and the results of numerous experiments with seeds are given.

Influence of Light.—Investigations carried out at the Institute at

Munich have shown that different seeds are differently affected by light; thus fresh seeds of *Nigella sativa* did not germinate in a seed bed open to the light, but when placed in the dark the whole of the seeds germinated after ten days. The seeds of many *Liliaceæ* were found to behave similarly, though here the action of light depended on the temperature, germination being seriously hindered by the light only in temperatures above 68° F.

On the other hand, about 200 species (including *Veronica officinalis*) could not be germinated in the dark; when brought suddenly into the light, however, after being kept for three years in the dark, they were found to germinate in a very short time. In many cases only a small amount of light was necessary for germination. Lights of different colour were noticed to act in different ways. A blue light was found to act in the same way as darkness, and had the additional effect of preventing the growth of harmful fungi and bacteria; 100 seeds of *Tofieldia* were kept for four years under a blue light and not one died. Germination ensued immediately on changing the blue to a red or white light. On the other hand, a blue light seemed to favour germination in the case of seeds which germinate in the dark, while red was unfavourable.

The sudden appearance of large numbers of some varieties of weeds in fields seems to be explained by the fact that in many cases germination is more complete and rapid where seeds have been kept for a considerable time in an unfavourable environment, and then brought suddenly into a favourable one. Thus it was found that seeds of *Digitalis purpurea* took eight months for the whole to germinate in the light in the ordinary way; but where they had been kept in the dark for three years the whole germinated in ten days after the admission of feeble light. Species of *Veronica* behaved similarly. Allowed to germinate in the ordinary way in the light, only 50 per cent. germinated in three years, but when kept in the dark for some time and then suddenly placed in the light, the whole of the seeds germinated. In the case of *Verbascum nigrum*, seeds kept in the light for three years germinated to the extent of 21 per cent., while 75 per cent. germinated where the seeds had been kept in the dark for three years and then placed in the light.

Influence of Frost.—Rostrup's and Dorph Petersen's experiments have established the fact that the seeds of 350 species of wild plants need frost for germination. Gentians (as a rule) and Primulas are well-known examples of seeds requiring frost before germination can take place. It is practically certain that all species of *Gentiana* can be caused to germinate by a long period of frost if sufficient moisture is present, but if kept in a dry condition the full effect is not produced. A frost which lasted over eight days in April caused *Cuscuta europea* and *C. Viciæ* to germinate. It is stated that a frost lasting over a whole winter would doubtless result in the germination of many species of seeds which had lain dormant for some considerable time.

A noticeable point in connection with these experiments was the different behaviour of different species of the same family, and it is evident that seeds are able to adapt themselves to varying conditions of climate, soil and light.

The Influence of Electricity on Micro-organisms (*Abstracts of Papers read at Meeting of Brit. Assoc.*, 1911; *Mr. J. H. Priestley and Miss E. M. Lee*).—Investigations were carried out to determine the effect of weak currents of electricity upon the rate of growth of micro-organisms as indicated by the rate of production of their metabolic products. The organisms selected were the "sour milk" bacilli of Professor Metchnikoff. A very active strain, producing 1·4 per cent. of lactic acid in ten hours was obtained, and pure cultures were used throughout. Currents of strengths varying from 0·3 to 80 microampères resulted in more rapid growth, the maximum effect apparently being produced by one of about 60 microampères. Currents of greater strength adversely affected the growth of the bacilli.

There was no appreciable difference between the effects caused by direct and alternating currents, from which it is concluded that no detrimental effect was produced in the former case by the accumulation of the products of electrolysis in the region of one electrode.

OFFICIAL NOTICES AND CIRCULARS.

Harvest Weather Forecasts.

Until the end of September the Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of the cost of the telegrams. The forecasts are drawn up each week-day at 2.30 p.m., and refer to the probable weather during the fifteen hours from 6 a.m. to 9 p.m. on the next day. A note as to the further outlook is given when possible. Forecasts are also prepared at 9.30 a.m. and 7 p.m., and can be sent in lieu of the afternoon telegrams on payment of 1*s*. 6*d*. per week for either service in addition to the cost of the telegrams.

Applications for the forecasts should be sent to the Director, Meteorological Office, South Kensington, London, S.W., with a cheque or postal order to cover the cost of the telegrams for the period, which should not be less than six consecutive days, during which the forecasts are to be sent. The telegrams are estimated to consist of sixteen words, exclusive of the address.

The office is also prepared to send notification by telegram of the expected commencement of spells of fine weather, and such further telegraphic notifications as may be necessary in order to keep the recipient informed of any further alterations in the outlook. For such a service a fee of 5*s*., which includes the cost of the telegrams, is payable in advance for each series of telegrams.

Memoir of the Geological Survey.

The Board of Agriculture and Fisheries desire to give notice of the publication of a Memoir of the Geological Survey on the British Carboniferous Trepostomata.

This Memoir, which represents Part 3 of the first volume of the Palæontological Monographs issued by the Geological Survey contains descriptions of 24 species of Bryozoa of the sub-order

Trepostomata from the Carboniferous rocks of Britain. Of these species, 23 are referred to previously described genera, while one is made the type of a new genus. The part contains 60 pages (qto.) with two collotype plates and one plate in line-process.

Copies may be obtained from any agents for the sale of Ordnance Survey Maps, or through any bookseller, from Mr. T. Fisher Unwin, 1 Adelphi Terrace, London, W.C., who is the wholesale agent for the sale of Geological Survey Memoirs in the United Kingdom (except in the county of London), price 3*s*.

Report of the Proceedings under the Small Holdings and Allotment Acts.

The Annual Report of the Land Division of the Board of proceedings under the Small Holdings and Allotments Acts, 1908 and 1910, and various other Acts for 1911, has recently been issued. Part I. (Cd. 6157, price 5½*d*.) relates to Small Holdings, and Part II. (Cd. 6173, price 3*d*.) to allotments and other subjects.

Report of the Intelligence Division.

Part I. of the Annual Report of the Intelligence Division of the Board for 1911, giving an account of the proceedings under the Sale of Food and Drugs Acts, the Fertilisers and Feeding Stuffs Act, and other Acts, has recently been issued (Cd. 6194, price 5½*d*.) and contains, among other matters, much interesting information as to sampling of imported food, adulteration of milk and dairy produce, analyses of fertilisers and feeding stuffs, and railway rates and facilities for the carriage of agricultural produce.

MISCELLANEOUS NOTES.

Importation Regulations.

Importation of Plants into Sierra Leone.—The Destructive Pests Ordinance of February 19th, 1912, empowers the Governor-in-Council to make such orders as may appear expedient for preventing the introduction into the Colony or Protectorate of any insect, fungus, or other pest, destructive to agricultural or horticultural crops or to trees or plants, and for preventing the spreading in the Colony or Protectorate of any such insect, fungus, or other pest.

Any such Order may provide for the prohibition of the importation or destruction of any plant or other article likely to harbour pests.

Special provision is made in the Ordinance for the prohibition of the importation of any cocoa tree or plant, or the leaves, branches, stems, roots, seeds, or fruit of any such trees or plants, except through the Port of Freetown and such other ports as may eventually be approved by the Governor.

All such trees, &c., before they are delivered to the importer, will be inspected by the Director of Agriculture, and if, in his opinion, they are likely to introduce any insect, fungus, or pest he may order them to be destroyed or disinfected. (*Board of Trade Journal*, March 28th, 1912.)

Importation of Pedigree Stock for Breeding into the United States.—The Kerry Hill breed of sheep, and the Large Black breed of pigs have now been recognised by the United States Department of Agriculture as pure breeds for the purposes of duty-free importation into the United States under the Act of Congress of August 5th, 1909, relating to the importation of pedigree stock for breeding purposes. The regulations with regard to the certification of pure-bred animals, together with the list of breeds of animals originally recognised, were given in this *Journal* for March, 1911, p. 1029.

Importation of Plants into the Gold Coast.—The Destructive Pests Ordinance of February 17th, 1912, empowers the Governor-in-Council to make such orders as may appear expedient for preventing the introduction into the Colony of any insect, fungus, or other pest destructive to trees and plants or crops, and also for preventing the spread in the Colony of any such insect, fungus, or other pest. Such order may prohibit or regulate the landing in the Colony of any tree, plant, &c., likely to harbour pests, and it may also authorise the treatment or destruction of such tree, &c. (*Board of Trade Journal*, May 2nd, 1912.)

Control of Plant Diseases in the Netherlands.—The Plant Diseases Law of July 17th, 1911, empowers the prohibition of the importation into and transit through the Netherlands of agricultural, horticultural, or forestry products, and waste products, packages, &c., where these articles are likely to introduce plant diseases.

With a view to combating the plant diseases already existing in the country, it is provided that if insects or plant diseases are prevalent to such an extent as to constitute a serious danger to agriculture, or horticulture, remedial measures can be prescribed. Provision can be made in this connection respecting the use, for combating insect pests, of substances harmful to the life or health of human beings or animals. The Act empowers compulsory inspection of premises for the detection of plant diseases. Compensation may be granted where plants are destroyed.

Agricultural Exhibition Abroad.

Exhibition of Horses and Donkeys in Paris.—The Board of Agriculture and Fisheries are informed that an Exhibition of native-breeding horses and donkeys will be held on the Champ du Mars, Paris, from June 19th to June 23rd, under the direction of the French Ministry of Agriculture.

Notes on Agriculture Abroad.

Potash from Kelp or Seaweed.—The United States Geological Survey have published, in a report entitled "Potash Salts, 1911," a description of a potash-producing plant which is now in actual operation in the United States. This plant is in southern California, about 30 miles north of San Diego, where operations in the commercial extraction of potash from kelp or seaweed were begun about March 1st. The plant consists of four furnaces capable of treating 6,000 lb. of dried kelp every 24 hours, and additional furnaces are under construction, with a proposed total capacity for treating 36,000 lb. of dried kelp daily.

According to information received from the British Vice-Consul at Ensenada, Mexico (Mr. W. D. Madden) it appears that the kelp growths already exploited along the North Pacific coast of America can be made to yield from two to three times as much potash as is now imported into the United States.

These huge seaweeds, it is stated, form exceedingly dense "groves," some of those along the Pacific coast being five miles long and two miles wide. They are rooted at the bottom among rocks, their stems being sometimes as much as 300 ft. long, and bearing at their tops great air-filled bulbs which serve as floats supporting enormous fronds of streamer-like leaves. From the ocean water they take up large quantities of potash salts, the dried plants containing from 25 to 35 per cent. of their weight of potassium chloride, which is easily extracted. They also contain iodine, and it is thought that this and other by-products would pay the cost of extracting potassium chloride. All the groves are within the three-mile limit. If properly protected, they will yield indefinitely, renewing themselves by fresh growth each spring. The "heaviest" growths are south of Point Sur, but large ones extend as far north as Seattle. The available output of potassium chloride from this source is estimated by the United States Department of Agriculture as equivalent to a value of 40,000,000 dols. (about £8,222,000) per annum. (*Board of Trade Journal*, April 18th and May 9th, 1912.)

Increase in the Productivity of Oats in the Netherlands.—The last sixty years have witnessed a remarkable increase in the productivity of oats in Holland. The extent of this increase will be seen from the following table compiled from official statistics of the Netherlands *:—

PRODUCTION OF OATS.

(*Bushels per Acre.*)

1851-1860	36·05	1881-1890... ...	42·75
1861-1870	37·52	1891-1900... ...	47·00
1871-1880	39·30	1901-1910.. ...	53·00

The record production of 55·20 bushels per acre took place in 1908, the yields in 1909 and 1910 showing small decreases from this amount, viz., 53·66 bushels and 50·21 bushels per acre respectively.

From the point of view of area under the crop the cultivation of oats in Holland is only exceeded in importance by rye and potatoes. There was a fairly steady increase in the acreage until 1904, when a record area of 357,562 acres was cultivated, but since this year the area under oats has fluctuated; the area in 1910 amounted to 348,285 acres.

Oats are cultivated principally in the provinces of Groningen, North Brabant, Limburg, Gelderland, and Zeeland. The average yield per acre in those provinces varies considerably. In 1910 the yields were:—Groningen, 62·45 bushels; North Brabant, 45·10 bushels; Limburg, 41·20 bushels; Gelderland, 37·41 bushels; and Zeeland, 57·44 bushels. The yield per acre in the province of Drenthe has more than doubled in the last sixty years.

---

* *Verslag over den Landbouw in Nederland*, 1910, and *Jaarcijfers voor het Koninkrijk der Nederlanden, Rijk in Europa*, 1909.

According to a report by H.M. Consul at Rotterdam, it is only since the introduction of good quality manures that the yields have increased, but the improvement is also doubtless to be ascribed to the cultivation of better varieties, varieties of oats having been much improved in the past twenty years.

Hop Vine Fibre as a possible Substitute for Hemp.—The British Vice-Consul at Leipzig (Mr. R. M. Turner) reports that, according to the *Spinner und Weber,* Herr Schatz claims to have discovered a new substitute for hemp for the textile and cord industries, in the fibre of the hop vine, from which the wooden and gummy substances are separated. The treatment is said to differ but slightly from that of hemp, and to have the advantage that the preliminary treatment can be undertaken by the hop-grower himself. The process of steeping (*Wasserröste*) is recommended for loosening the fibres. In the case of hop vines, however, greater care must be taken than with hemp not to miss the right moment for taking the plants out of the water. It is thought that, although the process as a whole is more troublesome than in the case of hemp, the cheapness of the raw material will more than compensate. It is intended to proceed with the spinning of the fibre obtained in the coming autumn after the hop-picking.

The following additional information is supplied by the inventor, regarding the process adopted for separating the fibre from the stalks:—

The hop stalks are, at the time of picking, cut into lengths of about 80 to 100 cm., stretched, and made up into bundles of from 15 to 20 cm. in diameter. After having been dried for one or two days, they are steeped in water. This process is most important and demands the greatest attention; its object is the destruction of the gummy, resinous substance between the "bast" and the wood. The bundles are laid in standing or running water, and kept down by stones; the under bundles must not, however, be allowed to touch the bottom. It is found that the steeping goes better in running water, as the fibres are less damaged. In both cases the time taken depends on the temperature of the water, and it is very difficult to judge the right moment at which to remove the bundles from the water. The sticky substance must be so thoroughly dissolved that there is no more power of adhesion between the bark and the wood, but if the bundles are kept too long in the water, the durability of the fibre will suffer. At a temperature of 77° Fahrenheit, the steeping should be complete in from 8 to 10 days in running water; in standing water in 14 days. It is impossible to lay down a fixed rule in either case.

The steeping is completed as soon as it is possible to remove the "bast" easily. When the "sticks" are taken from the water, they are spread out thinly over a meadow to dry; then they are again collected into small bundles and stacked, care being taken that the bundles are not piled one on top of the other for fear of generating heat. They are then stored in a dry and airy place. The "bruising" (*brechen*) is performed as time permits. If a man has enough labour at his disposal, he can have the "bast" stripped off and then swung at once, that is to say, the fibres freed from the "bast." Before the one or the other process is carried out, the vines must be very well dried; this can be done in a moderately warm oven, but this method of drying is not recommended, as it is found to render the fibres hard and brittle. (*Board of Trade Journal*, March 7th and May 16th, 1912.)

New Norwegian Artificial Manure.—The production of a new artificial manure, "biphosphate," is announced from Norway as a result of experiments at the Notodden Nitrate Works. The new fertiliser is a by-product of the nitrate of lime produced at these works, and is obtained without affecting the quantity of nitrate produced. Apatite or other raw materials are dissolved in the nitric acid and are then submitted to further treatment. A sample of the manure has been forwarded by H.M. Consul at Christiania to the Board of Trade, from whom small quantities may be obtained. The samples are stated to contain 26 per cent. of phosphoric acid (of which 92 per cent. is in citrate-soluble form) and 23·8 per cent. of nitrate of lime. It is also stated that the fertiliser will, in future, be placed on the market with considerably higher percentages of both phosphoric acid and nitrogen and at a low price. (*Board of Trade Journal*, March 7th, May 2nd, and May 16th, 1912.)

Cost of Producing Barley and Potatoes in the United States.—The inquiry which the Bureau of Statistics of the United States Department of Agriculture carried out with regard to the cost of producing various crops in 1909, and which was noticed in this *Journal* for November, 1911, p. 655, has included estimates of the cost of producing barley and potatoes.

Cost of Producing Barley.—As a result of the estimates of about 200 correspondents of the Bureau, the following average figures have been obtained:—

Cost per acre for—		£	s.	d.
Preparing ground for seed		0	7	8
Seed		0	4	9
Sowing		0	1	11
Harvesting		0	5	4
Preparing for market		0	6	3
Rent		0	13	2
Other items		0	2	9
Total cost per acre (including rent)		2	1	10
Yield per acre	bushels		27·6	
		£	s.	d.
Cost per bushel (including rent)		0	1	6
Value of grain:—				
Per bushel		0	2	2
Per acre		2	19	11

The total cost per acre varies from £1 10*s.* 2*d.* in Nebraska to £3 7*s.* 10*d.* in New York, the average for the whole of the United States being £2 1*s.* 10*d.* Noteworthy features of the return for the different States are the high cost of preparing ground for seed in New York and the high rental value of the land under barley in Iowa. The average size of the field of barley is about 44 acres; but in New York the average size is 10 acres, and in California 112 acres.

Yield of Barley.—The average yield of barley is 27·6 bush. per acre, varying from 23 bush. in Nebraska to 41 bush. in New York. The grain is also priced lowest in Nebraska and highest in New York.

Profit from Growing Barley.—The average value of the grain per acre is £2 19*s.* 11*d.*, so that the profit from growing barley works out at 18*s.* 1*d.* per acre for the whole of the United States. The profit is much greater than this in New York and California however.

Cost of Producing Potatoes.—The cost of producing potatoes has been calculated from the estimates of more than 4,000 correspondents of the Bureau of Statistics:—

	£	s.	d
Cost per acre of—			
Manures	0	13	8
Preparing ground for seed	0	14	1
Seed	1	2	4
Planting	0	9	11
Cultivation	0	13	2
Harvesting	1	4	1
Rent	0	16	8
Other items	0	7	1
Total cost per acre (including rent)	6	1	0
Yield per acre	118 bushels		
Cost per bushel (including rent)	1*s.* 0*d.*		
Average value per bushel	2*s.* 2*d.*		

The average cost for the whole of the United States is thus seen to be £6 1*s.* per acre, the cost in the case of the individual States varying from £4 17*s.* 10*d.* for the north-central States west of the Mississippi to £8 1*s.* 9*d.* for the North Atlantic States. As would be expected, the most important item in the case of the North Atlantic States is the cost of fertilisers, this being negligible in the case of the far western States.

Yield of Potatoes.—The yield varies from 84 bush. per acre for the south-central States to 137 bush. for the far western States, and 138 bush. for the North Atlantic States, the average for the whole country being 118 bush. per acre.

Plant Breeding in Germany.—Plant breeding in Germany began to assume importance in 1890, as a result of the success which attended the efforts of the first experimenters in this direction, the progress in the teaching of improved methods of cultivation in German universities, and the action of the German Agricultural Society as regards the improvement of seed. The formation of the Seed Improvement Section of the Society in 1886 led to the organisation of the efforts of individual breeders and to the spread of knowledge as to the improvements effected.

Among the means by which the work of the Seed Improvement Section is carried on are the following:—Lectures to farmers and scientists; competitions for the improvement of seeds; organisation of the tests of varieties, with the co-operation of agricultural institutions; inspection and recognition of the seeds of growers, as fulfilling certain requirements as to purity, &c.; the registration of improvements in plants carried out within the German Empire, with the object of promoting and protecting such improvements and of protecting buyers against fraud as to the origin of the seeds; the encouragement of the cultivation of clover and grass for seed; and participation in national and international exhibitions.

In addition to the Seed Improvement Section, the Society in 1888 inaugurated a "Seed Office." This office acts as intermediary between producers and consumers of seeds. Its object on the one hand is to create markets for the produce of reliable growers, and on the other to supply the buyers with varieties of known good quality, and to see that all requirements as to purity and germinating power are fulfilled.

Work of a similar nature to that of the German Agricultural Society is carried on by various other institutions, such as the Federation of Agriculturists, which has established a seed office and inspects seed farms; the agricultural co-operative societies, which undertake the sale of improved seeds; and the Society for Promoting the Improvement of Plants.

At the present time a large number of the States have their own associations for seed improvement, and the work is also carried on at agricultural institutes all over the country. There are State institutes for the improvement of seeds in Wurttemberg, Bavaria, Baden, and Saxony. (*Arb. Deut. Land. Gesell.*, *Heft* 168, *Abs. Bull. Bur. Agric. Int. and Plant Diseases*, January, 1912.)

Agriculture in the Transvaal and other South African Provinces (*Revue Économique Internationale*, Vol. iv., No. 3, December 15-21, 1911).—The area of a Transvaal farm is generally about 7,500 acres. The differences of altitude and the physical features of the country facilitate the cultivation, in certain regions, of semi-tropical plants, such as coffee, cotton, pine-apples, and bananas; in other parts horned cattle are to be found in large numbers, whilst horses and sheep are most general on the middle and high veldt and are a profitable source of income to their owners. Maize and other cereals are also grown on a large scale in some districts of the middle and high veldt; but all over the country there are vast tracts of land that have never been exploited in the European sense of the word.

Cattle.—There is no doubt that in the course of the last few years the quality of the cattle, kept by progressive farmers, has considerably improved, and it is probable it will continue to do so in the immediate future. The most widespread of the foreign breeds are the following, in order of importance:—Friesland, Shorthorn, Ayrshire, Devon, Hereford, and a few others, such as Jersey, Polled-Angus, Sussex, and Welsh.

The indigenous Afrikander breed and the animals which have become acclimatised are the species of cattle preferred by the Boers, and the recent precautions taken to preserve the purity of the race have greatly contributed to increase the popularity of this profitable kind of stock.

Horses.—The species of horse usually bred in the Transvaal is invaluable for riding, and as a beast of burden, is full of endurance, and unequalled as a draught horse for the Cape cart. A number of farmers are endeavouring to improve the quality and size of their stock. The Orange River Colony and various parts of Cape Colony are admirably suited to the breeding of horses.

Sheep.—The sheep are rapidly increasing in numbers. Generally speaking, these flocks are made up of a mixture of Cape, Mixed, Persian, and Merino breeds, except on the High Veldt, where numerous flocks of pure-bred Merinos are to be found. Goats, too, of various kinds, are not infrequently met with among the sheep; but the European breeds so common in England and Australia are hardly ever seen. Farmers owning the best sheep are concentrating their efforts on the production of wool rather than mutton.

Numbers of the principal sheep-breeders, at great expense, have imported rams from France, Tasmania, and Australia. Vast tracts of land in the Orange River and Cape Colonies are capable of producing excellent mutton as well as a fine quality of wool.

Pigs.—The pig is generally considered to be a negligible quantity on a Boer farm, but several European breeds have been imported, and in Natal, factories have been started for drying and smoking pork.

Poultry.—Poultry have greatly improved during the last few years, and nearly all the European and American breeds have been introduced.

Cereals.—Maize is more largely cultivated in the Transvaal than any other cereal. There is no doubt that both soil and climate favour its production.

Comparatively little wheat is grown, and the importation of flour seems to be on the increase. Thanks to the introduction of new varieties and the practice of dry-farming, it is hoped that it will soon be possible to satisfy all local requirements. The average crop on dry and irrigated land is estimated at about 7 sacks of 178 lb. per acre.

Oats are generally of inferior quality. The native malting barley is not very suitable for brewing. Barley is largely sown as a green crop for stock. Lucerne, millet, clover, and rye-grass are sown for forage. The growing of such crops as mangolds, rape, &c., is spreading rapidly. Soy beans have been recently introduced into the Transvaal. Tobacco is finding favour with an increasing number of farmers.

Other Crops.—Vegetable-growing is chiefly in the hands of the Portuguese, Italians, and Greeks. Many kinds of fruit are produced, from the subtropical kinds of the West Indies to the ordinary European fruits. A promising export trade is gradually being developed, and certain of the fruits thus exported fetch high prices on the London market.

Poultry Farming in Europe.—Information with regard to the poultry industry in several countries of Europe is given in the *Bulletin of the Bureau of Agricultural Intelligence and Plant Diseases,* February, 1912.

Italy.—Although carried on exclusively by small farmers with an utter absence of any scientific basis or system of rearing, and without any attempt at organisation in the sale of produce, poultry farming in Italy is of great importance. The net exportation (*i.e.*, surplus of exports over imports) of the products of the industry in 1911 amounted to £506,000 in the case of live and dead poultry, £1,197,000 worth of eggs, and £328,000 worth of feathers. During the last few years, however, the imports of fowls have increased and the exports of eggs have decreased, owing, it is stated, to increased home consumption, and not to any decline in the industry. Italy possesses excellent breeds in the Ancona, the Leghorn, and the Valdarno, the first two for egg production and the last for the table. The improvement in these breeds has been greater in foreign countries, however, than in

Italy. In the case of a farm in the province of Ravenna, which kept records, the average annual net income over three years was 2s. 4d per hen, with an annual production of 75 eggs, and annual cost for food of 2*s.* 2*d.*

France.—In 1875, France was about the only country that supplied England with eggs, and the latter then imported them to the value of from £1,200,000 to £1,400,000 per year; but now the imports of eggs into France far exceed the exports, as will be seen from the following figures:—

	Imports. cwt.	Exports. cwt.
1896	156,980	341,900
1910	515,400	168,325

Russia.—Poultry farming has made rapid strides in Russia during recent years, largely owing to the active steps taken to promote it by the Imperial Poultry Rearing Society. This Society consists of a central body at Moscow, with fifty branches in various provinces. Since its foundation in 1896 it has organised 300 poultry shows.

Russian exports of poultry and eggs are considerably larger than those of other European countries, but this is in great measure due to the size of the country and to the fact that the comparatively large tracts of land under cultivation facilitate the rearing and feeding of poultry at small cost.

For commercial purposes the Orpington, Wyandotte, Langshan, and Plymouth Rock are chiefly used; the last-named are specially plentiful in the Government of Moscow. The Rouen type predominates over all other foreign breeds of duck. As regards geese, Russia has several breeds of great value from an economic standpoint.

In the Volga territory, as well as in the west of the Empire, there are large establishments for fattening geese. In the Governments of Tambow and Woronesch the geese are frozen when killed, and kept till the following spring to be exported when market supplies are falling off. Fowls are treated in the same manner, the town of Kursk, the central market of southern Russia, supplying them alive in large quantities.

Since the construction of railways in central Russia, the exportation of eggs has become even more extensive than that of poultry; in 1910 2,998 million eggs were exported.

The Russian Government is trying to encourage poultry farming by granting travelling scholarships on condition that the holders of them shall organise special courses of instruction as soon as they return to Russia.

As a consequence of the low price of her eggs, Russia is gradually gaining the ascendancy on all the foreign markets.

Germany.—The Government aid for the promotion of poultry farming (chiefly on peasant farms) amounts to nearly £7,000 per annum in Prussia. In this and other states of the German Federation, experimental schools have been founded, having a twofold aim, viz., poultry-rearing and training for the same. Small breeding centres have also been formed, known as "Zuchtstationen" and "Muster-Geflügel-Höfe," under the management of the most active among the agriculturists. About 3,000 of these "Zuchtstationen" exist in Germany, 2,300 of which are given up to poultry farming.

Belgium.—In Belgium, where most of the farms are less than 25 acres in size, poultry-rearing has increased in a remarkable degree, owing no doubt to the united efforts of the members of the "National Federation of the Poultry-rearing Societies of Belgium," of which the number of branches rose from 29 to 131 and that of its members from 2,107 to 6,630 between 1898 and 1909. The Government gives an annual grant of £480 to this Association, in addition to which it provides for elementary courses of instruction in poultry farming. Belgium has made a speciality of rearing fowls for the table as well as of fattening for export.

Holland.—In Holland, too, small farms predominate, few of them being larger than 247 acres, so that poultry farming has been similarly taken up there. The "Dutch Association for the Rearing of Poultry and Rabbits," of which the headquarters are at the Hague, was started eight years ago; it now numbers 15,000 members, with 233 branch associations. During the last four years it has formed four co-operative societies, with 8,000 members, for the sale of eggs and poultry. This industry is, however, still chiefly carried on without co-operation.

Denmark.—The number of fowls reared in Denmark increased from 4½ to 11¾ millions between 1888 and 1909, so that there are now 439 fowls to every 100 inhabitants; the chief breeds are the native, the Italian, and the Minorca. Special attention is given to the production of choice eggs for exportation. This is carried on by associations, comprising 500 districts with 40,000 members. These societies have served as a model for the formation of similar societies in North Germany and Ireland.

Poultry-rearing in Denmark is carried on under careful Government supervision, three officials having been specially appointed to give instruction in poultry-rearing in the rural districts.

Budget of the Swedish Ministry of Agriculture for 1913.—The Budget of the Swedish Ministry of Agriculture for 1913 provides for an expenditure of £570,000, as compared with £475,000 for 1912. The increased expenditure of £95,000 includes increases of £2,000 on fisheries, £6,000 on ordnance survey, £15,000 on assistance to small holders, £9,000 on forestry and forestry education, £60,000 to facilitate the settling of the northern provinces, £20,000 on drainage works, and £22,000 on free carriage of manure. (*F.O. Repts., Annual Series,* No. 4837.)

Budget of the Austrian Ministry of Agriculture for 1912.—The sum of £2,561,000 is provided in the Austrian Budget of 1912 for expenditure on agriculture, as compared with £2,473,000 in 1911. The estimated expenditure in 1912 on various objects is as follows (*Bull. Bur. Agric. Int. and Plant Diseases, No.* 1, 1912):—

Central administration	78,000
Experiment stations...	38,000
Agricultural development	67,000
Plant protection	78,000
Forestry	3,000
Horse breeding	304,000
Veterinary service	196,000
State lands and forests	649,000

Budget of the Hungarian Department of Agriculture for 1912.—The Budget of the Hungarian Department of Agriculture provides for the following expenditure in 1912, as compared with 1911 (*Bull. Bur. Agric. Int. and Plant Diseases, No.* 1, 1912):—

	1912.	1911.
	£	£
Central Administration	63,000	58,000
Forestry	904,000	819,000
Horse-breeding	659,000	635,000
Veterinary service...	150,000	146,000
Agricultural Education and Experiment Stations	182,000	175,000
Cattle Breeding and Dairying	160,000	251,000
Fisheries, Viticulture, Agriculture, State Lands, Sericulture	542,000	509,000
Other expenditure	448,000	427,000
Extraordinary expenditure	965,000	750,000
	4,073,000	3,770,000

Agricultural Experiment Stations in Uruguay and Brazil.—According to the *U.S. Daily Consular and Trade Reports*, January 17th, 1912, a recent law provides for the establishment of six agricultural experiment stations in various parts of Uruguay, in addition to a practical dairy farm and a station for poultry raising. The law empowers the expropriation, for the use of each of the six experimental stations, of an area of land not exceeding 2,500 acres, and provides £4,300 for salaries and general expenses at each station, and a maximum sum of £172,000 for the expenses of expropriation, construction, and equipment.

A report in the *Board of Trade Journal*, February 8th, 1912, states that an expenditure of £10,000 is authorised by the Brazilian Budget for 1912 for the establishment of an experimental wheat-growing area in the State of Rio Grande do Sul.

Notes on the Weather in May.

During the *first* week (April 28th to May 4th) the weather was dry generally, but slight rain was experienced at times in the north-west and east, and late in the week rain fell in almost all parts of Great Britain. Temperature differed little from the average, and was everywhere classed as "moderate." Rainfall was much less than the average. In England S.W. the total amount was only 0·1 in., and in England N.E. and S.E., and also in the English Channel, less than 0·1 in. Bright sunshine just equalled the normal in Scotland W., and was slightly above it in Scotland N., but in all other districts it was deficient.

The weather during the *second* week, although generally fair and dry over the south-eastern quarter of England, was less settled than for a considerable time past. Except in the north and west of Scotland "very unusual" warmth was experienced, the excess of temperature above the average amounting to about 8° F. in England N.E. and the Midland Counties. Rainfall was considerably in excess of the normal in Scotland N. and slightly in excess in Scotland E. and W. and England S.W. In all other districts it was again deficient; at many places in the east of England the total quantity amounted to less than 0·05 in. Bright sunshine was generally "scanty" or "very scanty."

The changeable weather continued into the *third* week, and there were occasional falls of rain in all districts. "Moderate" warmth was experienced in Scotland and England N.W., but "unusual" warmth was recorded over the rest of England. Rainfall was considerably in excess of the average in Scotland N. and E. and England N.E., and slightly above it in the Midland Counties and England S.E.; elsewhere there was a deficiency which was large in most of the western districts. Bright sunshine varied considerably in amount in different parts of the country. As a rule it was in fairly close agreement with the average, but in Scotland E. and W. and England N.W. there was a rather large excess.

The conditions were generally cloudy and unsettled in the *fourth* week. Temperature was from 2° to 3° F. below the average in most districts, but slightly above it in England E. and the English Channel. Rainfall varied greatly in amount in different parts; it was in excess of the average in England N.E., the Midland Counties, and England N.W. and S.W., but in other districts there was a deficit. Bright sunshine was below the normal except in the English Channel and Scotland N.

During the *fifth* week the weather continued fine and dry generally until after the middle of the week, when there was a change to a showery and thundery condition. Temperature was rather more than a degree below the average over Great Britain generally, warmth being classed either as "moderate" or "deficient." Rainfall was "moderate" in all districts, except in Scotland N. and E., where it was "light." Sunshine was "abundant" only in England S.W., being either "scanty" or "moderate" elsewhere.

Agricultural Conditions in Great Britain in May.

The Crop Reporters of the Board, in reporting on agricultural conditions on June 1st, all refer to the droughty conditions of April and the greater part of May as having had a deleterious effect upon the corn crops. Rain during the last ten days or so of the month, however, effected a material improvement, but much more was needed. Wheat is now generally healthy and vigorous, though straw is short. But the crop is rather variable, and mostly thin on the poorer soils. Barley is hardly satisfactory, as germination has been very irregular nearly everywhere, especially among the later sown crops, and it is not yet all above ground. There are many reports of damage by wireworm. Rather more favourable reports of this crop come from the northern counties. Oats are also generally uneven, and suffering from lack of moisture; still the crop is healthy generally, though thin. The acreage under barley is rather less than last year, while that under oats is rather more. Beans, although short in straw, are generally promising, except in the west midlands, where frost has done much damage. Peas also promise fairly well.

Potatoes are generally looking fairly well, although they make but slow growth in the absence of rain, and the crops are not all yet above ground. In most districts frosts have done a little damage to the early crops. The area under potatoes is slightly larger than last year.

Mangolds are backward, and germinating slowly; some areas had not yet been sown. Where up, they are looking well, particularly since the recent rains, but in some localities the plant is patchy. More progress has been made with turnip and swede sowing in the north of England than in the south, where comparatively little has yet been done, owing to the drier conditions. In the northern counties and Scotland, in fact, this operation is more forward than usual; where it is up, the plant is looking well.

The long-continued drought had told very severely on the "seeds," and both clover and meadow-hay will be much below the average. The eastern, south-eastern, and midland districts are very much the worst, and considerable areas of "seeds" have been ploughed up. In the north and Scotland many districts report promise of good crops, although they are outweighed by the number of bad reports. The indications on June 1st were that in Great Britain, as a whole, the yield per acre of "seeds" hay would be only 87 per cent. of the average, while that of meadow-hay might be 92 per cent.

Hops are looking strong and healthy and growing freely, though somewhat unevenly in places. There is a great deal of vermin, and washing, in Kent, Sussex, and Hereford particularly, is already general. A rough survey indicates that the area under hops this year will be 3 to 4 per cent. greater than in 1911, most of the increase being in Kent.

Of fruit, strawberries would appear to be somewhat under average; there are rather more reports of large than of small crops, but more of the latter come from the chief strawberry districts, such as Kent. Raspberries are fairly promising; still more so are currants and gooseberries. Apples seem variable, but should probably be an over-average crop. Pears are much better, while cherries may possibly reach a bare average. Plums appear likely to be appreciably below average.

Pastures became very bare during the dry weather, but are much improved by the timely rains. Live stock have done fairly well during the month, although in some parts, as a result of the dried-up pastures, their condition is somewhat poor.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for May, 1912, states that the weather in Europe during April was generally dry and cold with night frosts, and the growth of autumn-sown crops was somewhat retarded; over-average crops, however, are generally expected. In *Germany* the condition of wheat and rye is estimated at 2·5 and 2·6 respectively, and in *Austria* at 2·4 and 2·5 respectively (1=very good, 2=good, 3=average, 4=bad, 5=very bad). Crops are in excellent condition in *Belgium*, and are expected to yield from 6 to 10 per cent. over average; but in *Denmark* autumn crops are late and poor yields are expected. Cold rains and night frosts have kept the crops back in *Hungary*, and on light soils great damage has been done. In *Croatia* and *Slavonia*, however, crops are still generally good. The condition of the crops in *Italy* was average on May 1st; vegetation was stopped by cold weather in the northern and central provinces, but much rain fell in the south, and the crops improved greatly. In *Russia* autumn-sown crops were generally satisfactory, although they were slightly inferior in the south. Crops were backward in *Roumania* and *Switzerland* owing to the cold weather.

It is estimated that 31 per cent. of the area sown with winter wheat in *Canada,* and 20 per cent. in the *United States,* have been abandoned, and the condition of this crop is reported to be well under average in each country.

Spring Sowing.—In *Belgium, Bulgaria, Denmark, Italy,* and *Roumania* spring sowing was completed under good conditions, but the cold dry weather experienced in Belgium and Denmark has retarded the growth of the crops. In *Austria* and *Hungary* crops are backward owing to the unfavourable weather during April, and the late sowings are not germinating well. When sowing was commenced in *South Russia* at the beginning of March, the land was in favourable condition.

Spring sowing was late in the north-west provinces of *Canada,* and in the Dominion as a whole 33·6 per cent. of spring wheat, 13·3 per cent. of oats, and 8·8 per cent. of barley were estimated to have been sown by May 1st.

Autumn Sowings in the Southern Hemisphere.—In *Chile* autumn cultivation was rather late, but was carried out under average conditions. Sowing was commenced in favourable weather and under good conditions. In *Australia* also the season was late, and in the north the weather conditions were unfavourable, but in the south favourable conditions prevailed.

Netherlands.—The production of sugar beet in 1911 was 1,972,740 tons, or 23·2 per cent. greater than that of 1910.

France.—The latest official report gives the total area sown with wheat as 16,172,000 acres, against 15,533,000 acres last year, winter wheat showing a good increase, whilst spring wheat has been sown on a much smaller area than in 1911. The condition is given as 75 for winter, and 78 for spring wheat, against 70 and 71 last year.

Barley has been sown on 1,868,000 acres, a decrease of 49,000 acres as compared with 1911. The condition of the crop is given as 76. Oats decreased from 9,947,000 acres in 1911, to 9,892,000 acres in 1912; the condition of this crop is given as 75 (100=very good, 80=good, 60=fairly good.) (*Journal Officiel,* May 19th.)

Russia.—H.M. Consul at Batoum reports on May 14th that an unbroken period of prolonged cold weather in the Caucasus has characterised the present spring. The prevailing abnormal conditions have in most cases done considerable injury to winter cereal crops in the northern Caucasus and the government of Astrakhan. The snowfall during the past winter was not sufficient to protect the growing crops from the severe morning frosts of March and April. Present agricultural conditions in the Trans-Caucasus are likewise very unsatisfactory. Owing to the exceptionally unfavourable weather conditions the growth of winter crops has received a serious check throughout the country, and in many localities the growing cereals have been blighted by frost. Plum, peach, and cherry crops are lost, and other fruits are much retarded in growth. Inclement weather conditions are also hindering the progress of spring cereal sowings.

United States.—H.M. Consul-General at Chicago reports on May 10th that remarkable decreases in acreage in all the chief winter wheat-producing States are shown by the May Government Crop Report. There is a loss of 6,469,000 acres, leaving but 25,744,000 acres to harvest, compared with 32,213,000 acres in 1911. This decrease of 20 per cent. is the largest ever known.

The greatest losses were in Illinois, Indiana, and Ohio, which, together with Michigan and Missouri, produce the bulk of the soft winter wheat crops. In nearly all these states the acreage abandoned is very large, being 53 per cent. in Illinois, 46 per cent. in Indiana, 45 per cent. in Ohio, 23 per cent. in Missouri, and 26 per cent. in Michigan. The crop in these five States promises to be only 70,000,000 bush., compared with 166,000,000 bush. in 1911. The total crop of winter wheat is estimated in the Report at 371,000,000 bush., as compared with a yield of 431,000,000 bush. last year. The average condition was 79·7 per cent., as compared with 86·1 per cent. a year ago.

Germany.—The report of the German Imperial Statistical Bureau gives the condition of the crops at the beginning of June as follows:—Winter wheat, 2·3; spring wheat, 2·3; winter rye, 2·6; spring rye, 2·4; barley, 2·2; oats, 2·4; potatoes, 2·7; clover, 3·4; and lucerne, 2·8 (1=very good, 2=good, 3=average, 4=small, 5=very small). The condition of clover and potatoes is not so good as in June, 1911, but the condition of the other crops is better. (*Deutscher Reichsanzeiger*, June 6th, 1912.)

Canada.—From reports compiled by the Census and Statistics Office at Ottawa to May 18th, the area sown with winter wheat is 1,097,900 acres, of which 797,200 acres were in Ontario, and 300,700 acres in Alberta. From reports of correspondents at the end of April it is estimated that about 31·5 per cent. of this area has been killed, the proportion being 28·7 per cent. in Ontario, and 38·5 per cent. in Alberta. This represents a total deduction from the area sown of about 345,000 acres. The average condition of winter wheat on April 30th was 72·62 per cent. of a standard (71·24 per cent. in Ontario and 76·80 per cent. in Alberta). From these figures it is calculated that the yield per acre from winter wheat in 1912 is likely to be about 20 bush. per acre, or 13 per cent. less than the average yield of the past three years.

India.—The final official estimate of the wheat crop in the Empire is 46,121,000 qr. in 1912, as compared with 46,533,000 qr. in 1911.

Sugar Beet in Russia.—The official "Trade Gazette" of May 25th publishes the following official statistics of the area of sugar beet in 1912. The total area under cultivation in Russia this year is 1,719,268 acres, or a decrease of 59,861 acres as compared with 1911. This year's area is made up of 548,100 acres owned by factories, an increase of 15,549 acres, and 1,171,168 acres owned by "plantations," a decrease of 75,410 acres compared with last year.

Live Stock Census in Argentina.—At the census of December 31st, 1910, the number of cattle was returned at 28,827,900, or 1 per cent. less than at the previous census of May 1st, 1908; horses, 8,435,141, or 12 per cent. more, and sheep 73,012,640, or 8·6 per cent. more than in 1908. (*Bull. of Agric. Stat., May,* 1912.)

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on June 1st, 1912, certain diseases of animals existed in the countries specified:—

Austria (*for the period May 15th—22nd*).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 307 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (*for the period April 1st—15th*).

Anthrax, Blackleg, Foot-and-Mouth Disease (11 "foyers" in 10 "communes"), Rabies.

Bulgaria (*for the period May 7th—14th*).

Anthrax, Dourine, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Denmark (*month of March*).

Anthrax, Foot-and-Mouth Disease (132 cases), Swine Erysipelas.

France (*month of March*).

Anthrax, Blackleg, Foot-and-Mouth Disease (687 "étables" in 421 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (*for the period May 1st—15th*).

Foot-and-Mouth Disease (1,969 infected places in 783 parishes), Glanders and Farcy, Swine Fever.

Holland (*month of April*).

Anthrax, Foot-and-Mouth Disease (31 outbreaks in 7 provinces), Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (*for the period May 1st—8th*).

Anthrax, Foot-and-Mouth Disease (total of 10 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (*for the period April 22nd—28th*).

Anthrax, Foot-and-Mouth Disease (86 new cases entailing 3,814 animals), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (*for the period April 1st—15th*).

(Foot-and-Mouth Disease (6 "étables" infected in 4 "communes").

Norway (*month of April*).

Anthrax, Blackleg, Swine Fever.

Roumania (*for the period May 5th—13th*).

Anthrax, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (*month of January*).

Anthrax, Foot-and-Mouth Disease (2,866 animals in 100 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period May 4th—11th).
Sheep-pox, Sheep-scab.

Spain (month of March).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (48,239 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of April).
Anthrax, Blackleg, Foot-and-Mouth Disease (2 outbreaks), Swine Fever.

Switzerland (for the period May 13th—19th).
Anthrax, Blackleg, Foot-and-Mouth Disease (26 "étables" entailing 297 animals, of which 9 "étables" were declared infected during the period), Rabies, Swine Fever.

Agricultural Labour in England during May.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in May:—

Owing to the continued fine weather agricultural employment was generally regular throughout May. Men outside the regular farm staff lost a little time through rain in parts of the Northern, Midland, and Eastern Counties, but such men were more generally affected by the dry weather, which lessened the demand for hoeing, resulting in some surplus of labour in a number of districts, particularly in the Eastern Counties. Men for permanent situations were again somewhat scarce in parts of the Southern and South-Western Counties.

Northern Counties.—Agricultural employment was generally regular throughout May in these counties, though a few extra labourers lost a little time through rain in the latter part of the month. The supply of and demand for extra men were about equal in most districts. A scarcity of men for permanent situations was reported in the Chorley (*Lancashire*) Rural District.

No general change in wages was reported to have taken place at the May hiring fairs held in Northumberland, Durham, and Yorkshire, though a correspondent in the Morpeth (*Northumberland*) Rural District reported some cases of an increase of £1 for the half-year.

Midland Counties.—Extra labourers were in fair demand in these counties for hoeing and weeding, planting potatoes, carting and spreading manure, and preparing the land for root crops; apart from some slight interruption from rain in certain districts, most men obtained regular employment. Some scarcity of men for permanent situations was reported in the Chesterfield (*Derbyshire*), Blyth-and-Cuckney (*Nottinghamshire*), and Southam (*Warwickshire*) Rural Districts.

Eastern Counties.—There was a fairly good demand for extra labourers in Cambridgeshire and Lincolnshire; in the other counties in this group the long-continued dry weather somewhat affected the employment of such men by reducing the amount of hoeing to be done, and there was some surplus of labour in a number of districts, including the Aylsham, Freebridge, Lynn, Henstead, Loddon-and-

Clavering, Smallburgh, and Swaffham (*Norfolk*), Thingoe (*Suffolk*), and Orsett (*Essex*) Rural Districts.

There was little change in wages on the whole at the May hirings in Lincolnshire.

Southern and South-Western Counties.—Extra labourers were principally in demand for hoeing and weeding, and carting and spreading manure. Dry weather, however, had the effect of lessening the demand for men for hoeing, and there was an excessive supply of such men in several districts, including the Blean, Hollingbourne (*Kent*), Havant (*Hampshire*), and Wantage (*Berkshire*) Rural Districts. A scarcity of extra men was, on the other hand, reported in the Thornbury (*Gloucestershire*), and West Penwith (*Cornwall*) Rural Districts. There was some scarcity of men for permanent situations in parts of the Godstone (*Surrey*), Chailey and Petworth (*Sussex*), Axbridge (*Somerset*), Hereford (*Herefordshire*), Stow-on-the-Wold and Thornbury (*Gloucestershire*), and West Penwith (*Cornwall*) Rural Districts.

THE CORN MARKETS IN MAY.

C. KAINS-JACKSON.

Wheat.—British grain during the month declined slightly in price, but the monthly mean of value was higher than for April, both at Mark Lane and at the inland centres. The London arrivals of imported wheat before Whitsuntide, May 1st to 23rd, were about 176,000 qr., but millers seem to have secured very little of it before the strike, and they were therefore dependent at the end of the month on the wheat actually in their mills. Prices for imported wheat closed 6*d.* to 1*s.* cheaper on the month for most sorts, 1*s.* to 2*s.* for Canadian. Without delivery guaranteed to a fixed date, Manitoba No. 3 closed at 40*s.* 3*d.* per 496 lb. (or 39*s.* for its natural weight, 480 lb.), a decline of 2*s.* from April 30th. Argentine and Russian were 1*s.* down, but Indian was not plentiful, and being in good demand for mixing was saleable at the old rates. Speculation in American new crop winter wheat was active during the month.

North American shipments freshened up very materially towards the close of the month. Foreseeing an early and free movement of new wheat, haste to dispose of the old wheat surplus was only to be expected. English millers note with satisfaction that it is wheat which is moving rather than flour; our dependence on imported flour tends rather to diminish than increase. The South American shipments for May were 2,116,000 qr., the Indian 282,000 qr., the Russian 774,000 qr., those of Europe S.E. 478,000 qr., and of Australasia 600,000 qr. Spring in Russia having been early and inland navigation resumed before the usual dates, the small exports of May are taken to be indicative of a real scarcity. As in June, 1911, Russia shipped 2,646,000 qr., the prospect of the shipments for June, 1912, not exceeding those of May (those of June, 1911, did not exceed those of May, 1911), amounts, it will be seen, to a menace of serious under-supply of a sort of wheat of which millers just now stand particularly in need. The total supplies of wheat on passage on May 31st were 3,800,000 qr., some decrease on the month.

Flour.—Town Household grade at the Mark Lane exchanges of May averaged 30*s.* ex mill, against 26*s.* for May, 1911, 28*s.* 3*d.*, 34*s.*, 28*s.* 9*d.*, 25*s.*, and 24*s.* for the five prior Mays. North American flour has gone back a little in value, especially for supplies not ex warehouse or in arrived vessels, but on passage. There are 120,000 sacks at present on the high seas, this total including Canadian as well as United States produce. Demand for flour has been below the average for the entire period under review. The offers from the mills being at the same time increased, prices are a little lower on the month. Supplies of country flour into London have been very fair for the time of year.

Barley.—There were on the 31st some 240,000 qr. of barley on passage, or rather less than half the quantity the buyer likes to see. The 240,000 qr. were thus divided :—Indian, 180,000 qr., Persian, 20,000 qr., Chilian, 30,000 qr., and Anatolian, 10,000 qr. The Indian is the largest recorded total, while Russian, Roumanian, and Californian shipments were absent. The shipments of the month were 300,000 qr. from India, 681,000 qr. from Russia, and 117,000 qr. from Europe S.E. Most of the Russian and Roumanian vessels were still on "the wrong side" of the Dardanelles at Whitsuntide, but by the end of May the congestion had been relieved. Much interest attaches to this Continental demand, which has taken some eight hundred thousand quarters of feeding barley in the course of a month, and has quite outbid the British market. The spot price in England of Russian and Roumanian barley is, of course, singularly high, 30*s.* to 31*s.* per 400 lb. Indian is mostly held for 29s., and Persian for 28*s.*; the Anatolian and Chilian types reach 448 lb. in weight, and fetch good brewing prices—35*s.* and upwards. Malt has kept up in price, 48*s.* being commanded by the finer samples.

Oats.—On the last day of the month Mark Lane saw nearly 28*s.* per 336 lb. paid for English oats out of the railway depôts. The more ordinary prices were 26*s.* 6*d.* for good Tartary, 27*s.* for black winter, and as much for grey. Supply is very small at this season. The very dry spring has much increased the demand for feeding stuffs to make up for deficient green feed, and June rainfall is now regarded as a greater determining factor on July prices than any usual market considerations. May shipments were: 42,000 qr. Canadian, 1,205,000 qr. Argentine, 235,000 qr. Russian. A few thousand quarters have been shipped across from North Germany, and fetch 25*s.* per 320 lb.

Maize.—Thirty shillings per quarter is a high price for this cereal, and as that price was exceeded in later April the rush to ship was marked. There are now over a million quarters on passage. Argentina sent off 1,488,000 qr., Russia 233,000 qr., Europe S.E. 478,000 qr., and India 80,000 qr. A price of 30*s.* was still making on the last day of the month for sound corn of whatever sort, while fine Calcutta, Morocco, and the like realised 35*s.* to 36*s.* The price for a cargo, July delivery, of sound new Argentine yellow was 25*s.* 3*d.* per 480 lb., which may be regarded as representing 27*s.* ex London warehouse for moderate quantities as needed.

Oilseeds.—Good Egyptian cottonseed ex warehouse has advanced on the month from 9*s.* to 9*s.* 6*d.* per cwt., and so genuine is the inquiry for actual needs that one can hardly use the word speculative of the purchases taking place of new crop for November shipment at 8*s.* 6*d.* Most of the buyers foresee a winter demand for which they feel they cannot be too fully prepared. The linseed market was also firmer on the month, though the official estimate of the Indian crop rather exceeded expectation. Good Indian and Russian exceeded 70*s.* on spot, when 64*s.* was commanded by the cheapest sort, Argentine. Supplies on passage on 31st included 200,000 qr. of linseed and 27,000 tons of cottonseed.

Various.—Beet sugar has ranged from 12*s.* to 13*s.* per cwt. in the wholesale market. The demand for it is excellent. Molasses have been looked up at 4*s.* 6*d.* per cwt. Other articles in which perhaps rather more business than usual has been doing include rice bran at 127*s.* 6*d.* to 130*s.* per ton, broken rice from Burma at 11*s.* 6*d.* per cwt., buckwheat from Russia at 30*s.* per 416 lb., canaryseed from Turkey at 50*s.* per 464 lb., and haricots from Burma at 44*s.* per 504 lb. The haricots and rice show some advance on the month. No sorghum appears to be on offer, but its place is mostly supplied by "mixed millet," sold at 28*s.* to 29*s.*, weight 416 lb. to the quarter.

THE LIVE AND DEAD MEAT TRADE IN MAY.

A. T. MATTHEWS.

Fat Cattle.—Although it is quite usual for supplies of finished cattle to fall off as those of stall-fed beasts become exhausted, and before any are coming from the pastures, the markets during May have felt the effect of that interval to an exceptional degree, and the position of sellers has been very strong. In the week ending May 29th the aggregate supplies at London, Newcastle, Norwich, and Salford were 25 per cent. smaller than the average of that week during the last three years, Salford being the only one of the above four showing a slight increase. This fact appears quite sufficient to account for a further advance in prices.

Shorthorns in the English markets showed an advance of about 3*d.* per stone of 14 lb., as compared with the April averages, and Herefords and Polled Scots an even greater one. The following were the average prices of the various breeds:—Shorthorns, 9*s.* 5*d.* for first, and 8*s.* 6*d.* for second quality, against 9*s.* 2*d.* and 8*s.* 4*d.* in April; Herefords, 9*s.* 8*d.* and 8*s.* 9*d.*, against 9*s.* 4*d.* and 8*s.* 8*d.*; Devons, 9*s.* 4*d.* and 8*s.* 3*d.*, against 9*s.* 3*d.* and 8*s.* 3*d.*; and Polled Scots, 9*s.* 8*d.* and 8*s.* 10*d.*, against 9*s.* 4*d.* and 8*s.* 8*d.* The above prices are fully 1*s.* per stone higher than those ruling in May, 1911.

Grazing prospects in the southern counties are not very good, and store cattle are in lower condition than usual, to start with. Supplies are therefore likely to continue small for some time to come, and lower prices for good cattle are considered to be extremely improbable. The threatened scarcity of grass may, however, produce forced sales of immature animals.

Veal Calves.—Fat calves were plentiful and prices were moderate, the average in about twenty-three English and Scottish markets being 8½*d.* per lb. for first and 7¾*d.* for second quality. This was a decline from April prices of ¾*d.* on first and ¼*d.* on second quality.

Fat Sheep.—In the English officially quoted markets for the last week of the month, the number of sheep and lambs on offer was some 5,000 less than the previous three years' average. There was, perhaps, some slight improvement in the general condition, and prices continued to harden. Downs in English markets averaged 9*d.*, 8¼*d.*, and 6¾*d.* per lb. for the three qualities, against 8½*d.*, 8*d.*, and 6½*d.* in April. Longwools averaged 8½*d.*, 7¾*d.*, and 6*d.*, against 8¼*d.*, 7½*d.*, and 5¾*d.*, all these prices being for clipped sheep. The scarcity of well-fed mutton was demonstrated by the unwonted readiness of sale of heavy Kent Longwools in London. These sheep are two years old, and weigh from 80 to 96 lb. Frequently, in ordinary seasons, thousands of them fail to find customers at Islington, but just now they are taken freely at about 8*d.* per lb.

Fat Lambs.—Lambs have been freely marketed, but the general condition has been inferior, and trade very slow. Many thousands have been sacrificed at very low prices which can scarcely remunerate sellers. As compared with April figures, first quality declined, on the average of about forty-two British markets, to the extent of 1¾*d.* per lb., and second quality 1¼*d.* The average price was 11¼*d.* for first and 10*d.* for second quality. At Islington during the last week the best lambs on offer fetched less money per lb. than prime Down tegs. Many have been sold at 25*s.* each and even less, and should there be a fair crop of turnips they will be badly wanted in the autumn.

Fat Pigs.—There was slow but steady improvement in the value of bacon pigs, and the May averages in about thirty British markets were 6*s.* 11*d.* per 14 lb. stone for prime small, and 6*s.* 3*d.* for larger pigs.

Carcass Beef—British.—Scotch and English beef was a fairly steady trade during the first fortnight, but in the third week there was a sharp advance of 6*d.* per stone on Scotch and 3*d.* on English sides, but this was partially lost in the last week in spite of the strike scare then prevailing. The following are the averages for the month at Smithfield:—Scotch short sides, 5*s.* 3*d.* and 5*s.* for first and second quality; long sides, 4*s.* 11*d.* and 4*s.* 9*d.*; English, 4*s.* 9*d.* and 4*s.* 7*d.* The highest prices touched were 5*s.* 6*d.* for Scotch long sides and 4*s.* 11*d.* for English.

Port-Killed Beef.—Deptford-killed beef was by no means plentiful, and was quickly cleared at fully English prices. There is no distinction made between the two descriptions in the retail trade.

Chilled Beef.—There was no shortage in the supplies of Argentine chilled, but prices were artificially raised by a panic at the end of the month, caused by the Thames strike. On the 28th as much as 4*s.* 4*d.* per 8 lb. was obtained for hindquarters, but excitement subsided on the following day, and prices fell heavily. The averages for the month were 3*s.* 9*d.* and 3*s.* 6*d.* for hindquarters, and 2*s.* 6*d.* to 2*s.* 4*d.* for fores.

Frozen Beef.—Frozen beef fully participated in the inflation of prices owing to the strike, but quite apart from that influence there was a good, steady trade. New Zealand touched 3*s.* 6*d.* per 8 lb. on the 28th for hindquarters, and averaged 3*s.* 1*d.* and 2*s.* 11*d.* for hinds, and 2*s.* 5*d.* and 2*s.* 4*d.* for fores. Australian made from 1*d.* to 2*d.* per stone less.

Carcass Mutton — Fresh-Killed.—British and Dutch mutton advanced 2*d.* per 8 lb. stone after the second week, and remained remarkably steady to the close at the following prices:—Scotch, 5*s.* 11*d.* and 5*s.* 8*d.*; English, 5*s.* 4*d.* and 5*s.*; and Dutch, 5*s.* 4*d.* and 5*s.* per stone, showing a very considerable advance on April values.

British Lamb.—This article was very slow of sale and cheap in proportion to prime mutton. The average prices were 6*s.* 4*d.* and 5*s.* 10*d.* per 8 lb., or slightly lower than those of a year ago.

Frozen Mutton and Lamb.—Frozen mutton sold quietly at some advance, the strike not affecting its value. New Zealand averaged 2*s.* 11*d.* and 2*s.* 7*d.*, against 2*s.* 9½*d.* and 2*s.* 5*d.* in April. Argentine and Australian fetched 4*d.* and 2*d.* less respectively. Frozen lamb, however, went to an almost unprecedented price, and closed at 5*s.* per 8 lb., having touched 5*s.* 4*d.* on one day for prime Canterbury. The averages for New Zealand were 4*s.* 4*d.* and 3*s.* 11*d.* for the month, and Australian 4*d.* less. Argentine lamb had more the character of teg mutton.

Veal.—Trade in veal was steady at 4*s.* 4*d.* to 5*s.* 1*d.* for English, and 4*s.* to 5*s.* for Dutch, except in the third week, when values were 4*d.* per 8 lb. higher all round.

Pork.—There was a considerable trade in pork in London for the time of year, and prices were steady, with an advance of 6*d.* per stone in the last week. Dutch was worth about the same as English, the averages for the month being 4*s.* 3*d.* and 3*s.* 11*d.* for the latter, and 4*s.* 3*d.* and 3*s.* 10*d.* for the former.

THE PROVISION TRADE IN MAY.

HEDLEY STEVENS.

Bacon.—The general advance in prices reported last month, received a check early in May, and as a consequence buyers have acted very cautiously since.

The arrivals of long sides from Denmark have been free, but a large proportion of the meat was found to be cut from small, immature hogs, showing that breeders continue to slaughter their young stock on account of the high price of feed. The imports from the United States and Canada were again small, but with the reduced consumption there has been some accumulation of stock from the former country. The latest cables from Canada report that very high prices for hogs are ruling there, bringing the cost of manufactured long sides delivered at English ports to 76*s*. to 78*s*. per cwt. As a result of these high prices one Canadian packing house has stopped killing for the English markets, and others will doubtless follow.

The receipts of hogs in America have been fairly liberal, prices on the Chicago market ranging from $7.15 to $8.05, against $5.35 to $6.40 at the same time last year, and $9.20 to $9.80 two years ago.

Prices for English pigs have hardened since last month, and with warmer weather and consequently a larger consumption of cured meats, it is anticipated that values will gradually advance.

Cheese.—At the beginning of the month a determined effort was made to reduce prices, but with the small stocks of old cheese available, a reaction quickly took place, and in a few cases as much as 80*s*. per cwt. has been paid for best old Canadians. The labour troubles in London at the end of the month also helped to advance prices materially, on available stocks of New Zealand makes.

Unusually high prices have been paid for the early make of Canadians for immediate shipment, that market being about 15*s*. per cwt. above last year. The Canadian season was a little backward at first, but the latest cables report that the weather conditions are good and that a large make is in progress. Spot values of new Canadians are 68*s*. to 70*s*., against 54*s*. to 56*s*. last year.

The estimated stock of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month was 24,000 boxes, against 65,000 at the same time last year, and 99,000 two years ago.

The conditions for cheese-making in this country have been good throughout the month, and it is generally reported that a larger make is in progress than for many years past, prices being remunerative although lower than for the imported early makes.

Butter.—The demand for this article has been quiet on the whole, with little change in prices, say about 10*s*. to 12*s*. above last year, until the last week in the month, when all values were slightly advanced on account of the labour troubles at the London Docks. Practically all supplies of New Zealand and Australian, as well as Siberian, butters were held up either in the ships or cold stores. Fortunately, however, buyers had already turned their attention to Irish, the production of which has been fairly good and the quality very fine. At the time of writing rain is badly needed in all the butter-making districts. Shipments from Australia are now practically finished.

Canadian and United States butters are still above an export basis, although those markets are a little easier, with larger arrivals.

Eggs.—Prices have shown little variation except for a slight rise when the strike was first declared at the London Docks, but this was soon lost when the merchants released the arrivals from Russia by means of their own labour. Shipments from that country have been fairly free during the month.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of May, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	9 8	8 10	43 7	39 11
Herefords	9 8	8 9	—	—
Shorthorns	9 5	8 6	42 8	39 2
Devons	9 4	8 3	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	8½	7¾	9	7¼
Sheep:—				
Downs	9¼	8¼	—	—
Longwools	8½	7¾	—	—
Cheviots	9¾	9¼	10	8¾
Blackfaced	9½	8½	9¼	8
Cross-breds	9	8¼	10¼	9
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Bacon Pigs	7 1	6 6	6 6	5 8
Porkers	7 4	6 10	7 1	6 3
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	*£ s.*	*£ s.*	*£ s.*	*£ s.*
Shorthorns—In Milk ...	20 16	17 12	22 6	17 19
,, —Calvers... ...	20 10	17 4	19 2	17 6
Other Breeds—In Milk ...	17 15	15 15	18 9	15 14
,, —Calvers ...	13 7	11 12	18 14	16 0
Calves for Rearing	2 6	1 15	3 0	2 4
Store Cattle:—				
Shorthorns—Yearlings ...	9 17	8 3	11 6	9 4
,, —Two-year-olds...	14 10	12 6	16 0	13 13
,, —Three-year-olds	18 8	15 18	—	—
Polled Scots—Two-year-olds	—	—	17 13	14 7
Herefords— ,,	15 8	13 9	—	—
Devons— ,,	14 16	12 18	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Downs or Longwools ...	42 7	35 11	—	—
Scotch Cross-breds ...	—	—	35 11	30 9
Store Pigs:—				
8 to 10 weeks old	17 1	13 11	20 3	15 1
12 to 16 weeks old	27 2	20 7	25 0	17 4

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of May, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Liverpool.		London.		Manchester.		Edinburgh.		Glasgow.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF:—													
English	1st	65	6	64	0	66	6	65	0	66	6*	65	0*
	2nd	60	6	60	6	64	0	60	6	62	0*	62	6*
Cow and Bull ...	1st	56	0	54	0	53	0	55	0	57	6	56	6
	2nd	50	6	49	6	47	6	50	6	50	6	52	0
U.S.A. and Canadian:—													
Port Killed ...	1st	—		65	6	66	6	—		—		—	
	2nd	—		62	6	64	0	—		—		—	
Argentine Frozen—													
Hind Quarters...	1st	42	0	41	0	43	0	41	0	40	6	43	6
Fore ,, ...	1st	33	6	33	6	33	6	33	6	34	0	34	6
Argentine Chilled—													
Hind Quarters...	1st	52	6	52	0	52	6	52	0	53	0	54	0
Fore ,, ...	1st	36	6	36	0	35	6	36	0	36	6	38	6
Australian Frozen—													
Hind Quarters...	1st	40	0	38	6	41	6	38	6	—		41	0
Fore ,, ...	1st	32	6	31	6	33	0	31	6	—		33	6
VEAL:—													
British	1st	67	6	72	0	71	0	71	6	—		71	0
	2nd	60	6	66	6	62	6	65	6	—		66	6
Foreign	1st	—		—		71	0	—		73	6	69	0
MUTTON:—													
Scotch	1st	—		82	0	83	0	84	0	82	6	87	0
	2nd	—		79	6	79	0	79	0	76	6	72	0
English	1st	74	0	76	6	74	6	78	0	—		—	
	2nd	61	6	72	0	70	6	72	6	—		—	
Argentine Frozen ...	1st	36	6	37	6	36	6	37	6	36	0	36	6
Australian ,, ...	1st	35	0	35	0	35	0	35	0	—		34	0
New Zealand ,, ...	1st	36	6	—		41	0	—		—		38	6
LAMB:—													
British	1st	88	6	94	6	88	6	95	0	106	0	112	0
	2nd	82	0	87	6	82	0	87	0	95	0	100	6
New Zealand ...	1st	61	0	59	6	60	6	59	6	62	0	59	6
Australian	1st	53	6	52	6	53	0	52	6	—		52	6
Argentine	1st	52	6	52	6	51	6	52	6	49	0	52	6
PORK:—													
British	1st	62	0	56	6	60	0	59	6	56	0	58	0
	2nd	57	0	51	6	55	0	55	0	51	0	56	0
Foreign	1st	—		—		59	6	—		—		—	

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6 ...	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
„ 13 ...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
„ 20 ...	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
„ 27 ...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3 ...	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
„ 10 ...	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
„ 17 ...	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
„ 24 ...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2 ...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
„ 9 ...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
„ 16 ...	32	6	30	1	34	0	23	6	24	11	31	2	18	0	17	6	21	8
„ 23 ...	32	9	30	2	34	1	23	7	25	0	31	10	17	11	17	5	21	9
„ 30 ...	33	0	30	3	34	4	23	8	24	11	30	3	18	0	17	5	21	8
Apl. 6 ...	33	6	30	4	34	10	23	1	24	7	30	9	17	11	17	7	21	11
„ 13 ...	33	7	30	3	35	4	23	5	25	2	30	2	18	3	18	3	22	1
„ 20 ...	33	7	30	4	36	7	23	0	25	5	29	11	18	3	17	10	22	4
„ 27 ...	33	0	30	11	37	10	22	10	25	5	30	4	18	3	18	3	22	9
May 4 ...	32	6	31	4	38	1	22	7	25	7	30	2	18	2	18	6	23	1
„ 11 ...	32	1	31	8	37	11	22	0	25	1	31	1	18	1	19	0	23	7
„ 18 ...	31	10	32	6	37	8	21	8	25	4	31	2	17	8	19	2	23	7
„ 25 ...	31	3	32	8	37	2	21	4	25	0	31	1	17	10	19	5	23	7
June 1 ...	30	2	32	5	36	10	21	8	24	10	30	0	17	10	19	5	23	9
„ 8 ...	29	1	32	4			20	9	25	7			17	10	19	7		
„ 15 ...	29	0	32	3			18	11	23	11			18	0	19	8		
„ 22 ...	29	4	31	11			20	1	23	9			17	9	19	10		
„ 29 ...	29	9	31	10			19	11	24	5			17	7	19	9		
July 6 ...	30	4	32	1			19	5	25	10			17	4	19	9		
„ 13 ...	31	1	32	3			21	3	25	10			17	7	19	11		
„ 20 ...	31	11	32	5			19	9	24	3			17	5	19	5		
„ 27 ...	33	5	32	5			20	10	23	8			18	1	19	7		
Aug. 3 ...	33	9	32	0			20	5	24	4			18	3	18	2		
„ 10 ...	33	5	31	6			20	4	26	9			18	0	18	0		
„ 17 ...	32	11	31	6			20	11	27	8			17	11	17	10		
„ 24 ...	32	7	31	8			20	10	28	10			17	2	18	0		
„ 31 ...	32	2	31	7			22	10	28	4			17	2	18	3		
Sept. 7 ...	31	11	31	10			23	3	28	4			17	2	18	1		
„ 14 ...	30	11	32	0			24	3	29	0			16	6	18	5		
„ 21 ...	30	2	32	4			24	2	29	11			16	3	18	9		
„ 28 ...	30	1	32	6			24	4	30	5			16	4	19	1		
Oct. 5 ...	30	1	32	7			24	7	30	9			16	3	19	5		
„ 12 ...	30	2	32	9			25	1	31	0			16	2	19	10		
„ 19 ...	30	4	32	9			25	3	31	5			16	1	19	11		
„ 26 ...	30	4	33	1			25	4	31	7			16	2	20	6		
Nov. 2 ...	30	4	33	4			25	6	31	10			16	2	20	8		
„ 9 ...	29	11	33	4			25	4	32	7			15	11	20	11		
„ 16 ...	29	8	33	1			25	1	32	10			16	1	21	0		
„ 23 ...	29	11	33	0			24	10	33	5			16	4	20	10		
„ 30 ...	30	6	32	10			24	7	33	10			16	7	20	11		
Dec. 7 ...	30	9	32	9			24	3	34	0			16	9	20	9		
„ 14 ...	30	7	32	11			23	9	33	5			16	10	20	9		
„ 21 ...	30	7	32	9			23	10	33	5			16	9	20	8		
„ 28 ...	30	5	33	0			23	9	33	4			16	9	20	7		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb: Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1911.	1912.	1911.	1912.	1911.	1912.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	April	45 11	49 7	26 6	30 2	21 11	24 0
	May	46 9	52 8	27 2	30 9	22 8	24 6
Paris:	April	46 1	52 2	24 8	29 5	23 4	25 8
	May	49 3	54 0	25 7	29 9	23 11	25 2
Belgium:	March	32 5	35 3	24 7	30 7	19 8	24 11
	April	32 10	38 0	24 7	31 10	20 8	26 3
Germany:	March	40 6	44 6	29 0	35 10	22 3	27 8
	April	40 7	47 0	29 6	36 2	23 1	28 4
Berlin:	March	42 6	45 5	—	—	21 8	27 8
	April	42 10	—	—	—	22 3	—
Breslau:	March	37 10	40 4	27 7* 22 11†	32 10* 28 11†	20 1	25 7
	April	38 1	—	27 7* 23 7†	— —	20 11	—

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of May, 1911 and 1912.

—	Wheat.		Barley.		Oats.	
	1911.	1912.	1911.	1912.	1911.	1912.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London...	33 4	38 8	25 4	30 7	20 4	24 3
Norwich	31 10	37 7	23 3	30 2	18 8	23 5
Peterborough	31 11	37 0	24 6	31 1	18 10	23 4
Lincoln...	31 5	37 2	23 6	30 0	19 6	23 6
Doncaster	31 2	36 10	25 0	28 7	19 0	23 5
Salisbury	31 10	37 6	23 4	31 10	18 9	23 8

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of May, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	14 0	12 6	—	—	13 6	12 6	14 6	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	111 0	107 0	109 6	106 0	113 6	111 6	107 6	103 0
,, Factory ...	105 0	99 0	101 0	96 0	107 6	103 6	—	—
Danish ...	—	—	120 0	118 0	119 0	117 0	114 6	—
French ...	—	—	—	—	127 6	120 0	—	—
Russian ...	109 6	107 0	109 6	106 6	109 0	106 0	108 0	—
Australian ...	112 0	108 0	110 0	107 6	110 0	107 0	—	—
New Zealand	114 0	110 6	113 0	111 0	113 6	111 0	106 0	—
Argentine ...	109 0	107 0	107 0	105 0	110 6	107 0	—	—
CHEESE :—								
British—								
Cheddar ...	93 0	84 0	92 0	89 0	71 6	67 0	63 6	61 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	66 0	60 6	75 0	64 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	75 6	74 0	72 0	70 6	76 0	74 0	64 6	—
BACON :—								
Irish	74 0	69 0	73 0	68 0	75 0	71 6	69 0	—
Canadian ...	69 6	67 0	68 0	65 0	70 0	67 0	69 6	67 6
HAMS :—								
Cumberland ...	—	—	—	—	104 0	91 0	—	—
Irish	—	—	—	—	97 6	90 0	104 0	102 0
American (long cut)	65 0	62 0	67 0	62 0	69 0	67 0	67 0	66 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	9 2	8 4	—	—	10 0	9 2	8 11	—
Irish	8 6	8 0	8 4	7 8	8 8	8 1	8 1	7 7
Danish ...	—	—	—	—	9 2	8 4	9 6	8 7
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
Edward VII.	82 6	71 6	56 6	51 6	76 0	69 0	—	—
Langworthy ...	80 0	75 0	76 6	71 6	93 0	84 0	60 0	55 0
Up-to-Date ...	75 0	62 0	50 0	43 6	80 0	68 6	51 6	47 0
HAY :—								
Clover ...	115 0	105 0	122 6	105 0	122 0	100 0	100 0	95 0
Meadow ...	110 0	100 0	—	—	116 6	94 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	MAY.		FIVE MONTHS ENDED MAY.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	55	69	449	41
Animals attacked	58	105	502	50
Foot-and-Mouth Disease :—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	18
Glanders (including Farcy) :—				
Outbreaks	12	17	69	88
Animals attacked	15	27	149	241
Parasitic Mange :—				
Outbreaks	157	—	1,917	—
Animals attacked	322	—	4,307	—
Sheep-Scab :—				
Outbreaks	9	5	158	297
Swine-Fever :—				
Outbreaks	301	261	1,407	1,016
Swine Slaughtered as diseased or exposed to infection ...	3,838	2,828	17,863	10,797

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	MAY.		FIVE MONTHS ENDED MAY.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	1	2	2	5
Animals attacked ..	1	2	2	5
Glanders (including Farcy) :—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	2
Parasitic Mange :—				
Outbreaks	6	1	37	38
Sheep-Scab :—				
Outbreaks	9	12	250	236
Swine-Fever :—				
Outbreaks	23	4	110	49
Swine Slaughtered as diseased or exposed to infection ...	408	17	1,120	816

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

Contributions to our Knowledge of Soil-Fertility. ii., The Determination of Rhizobia in the Soil, *R. Greig-Smith.* (Proc. Linn. Soc. N.S. Wales, Vol. XXXVI., Part 3, 1911.) [63.113; 63.115.]

Etudes expérimentales sur les engrais catalytiques, *E. Boullanger.* (Ann. Sci. Agron., Mars, 1912.) [63.167.]

Die Wanderungen der Mineralstoffe beim herbstlichen Absterben der Blätter, *E. Ramann.* [58.11.] Mineralstoff-Wanderungen beim Erfrieren von Baumblättern, *E. Ramann.* [58.11.] Wasser und Licht als Vegetationsfaktoren und ihre Beziehungen zum Gesetze vom Minimum, *Th. Pfeiffer, E. Blanck* und *M. Flügel.* [58(04).] Veränderungen, welche bei der Dürrheubereitung im Grase vor sich gehen, *Dr. Fritz Fleischmann.* [63.198.] (Landw. Vers. Stat., Band LXXVI., Heft III.–VI., 1912.)

Mendelistische Studien an Rüben, *Birgir Kajanus.* [575.4.] Die Grundlage der Variationsstatistik und ihre praktische Anwendung, *Dr. Quante.* [575.1.] (Fühling's Landw. Ztg., 15 Februar, Heft 4, 1912.)

A Further Contribution to the Study of Right- and Left-Handedness [in plants], *R. H. Compton.* (Jour. Genetics, Vol. 2, No. 1, February, 1912.) [575.1; 58.11.]

Toxic Effects of "Alkali Salts" in Soils on Soil Bacteria. II., Nitrification, *C. B. Lipman.* (Centbl. Bakt. [etc.], 2e Abt., 33 Bd., No. 11–14, 2 März, 1912.) [63.115.]

Rothamsted Experiments, *A. D. Hall.* [37(072).] The Irish Experiments, *J. Wilson.* [37(072).] The Chemical Composition of Farmyard Manure as a Measure of its Value, *Charles Crowther.* [63.1622; 63.163.] (Trans. Highland and Agr. Soc. Scot., Vol. XXIV., 1912.)

Field Crops—

Der Einfluss der Düngung und Bearbeitung der Wiesen auf den Ertrag, den Pflanzenbestand und die chemische Zusammensetzung des Heues, *Dr. G. Bredemann.* (Fühling's Landw. Ztg., 5 u. 6 Hefte, 1 u. 15 März, 1912.) [63.33–16.]

Top-Dressing Pastures (Phosphate, Potash, and Lime), *R. Shirra Gibb.* (Trans. Highland and Agr. Soc. Scot., Vol. XXIV., 1912.) [63.33–16.]

A Method of determining the Baking Strength of Single Ears of Wheat, *H. W. Harvey* and *T. B. Wood.* (Rpt. Brit. Assoc. Adv. Sci., 1911.) [63.311; 664.6.]

Plant Diseases—

Ortho Arsenite of Zinc as an Insecticide, *R. A. Cooley.* [63.295.] Recent Experiments with the Codling Moth, *E. P. Felt.* [63.27.] (Jour. Econ. Ent. [Concord, N.H.], Vol. 5, No. 2, April, 1912.)

Ein neuer Krebserreger des Apfelbaumes, ***Phacidiella discolor*** (Mout. et Sacc.), A. Pot., seine Morphologie und Entwicklungsgeschichte, *A. Potebnia.* (Ztschr. Pflanzenkrank., XXII. Band, Heft 3, 1912.) [63.24.]

Live Stock—

A Critical Examination of Recent Studies on Colour Inheritance in Horses, *A. H. Sturtevant.* (Jour. Genetics, Vol. 2, No. 1, February, 1912.) [575.1; 63.61.]

Bacon Curing on the Farm, *Loudon M. Douglas.* [664.91.] **Goats: Their Use and Management**, *H. S. Holmes Pegler.* [63.63.] (Trans. Highland and Agr. Soc. Scot., Vol. XXIV., 1912.)

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Pronunciation of Plant Names. (94 pp.) London: The Gardeners' Chronicle, Ltd., 1909. 1*s.* net. [58(02).]

Kanngiesser, F.—Die akuten Vergiftungen: Ein Vademecum für die ärztliche Praxis. (52 pp.) Jena: Gustav Fischer, 1911. 1 M. [54(04).]

Kew, Royal Botanic Gardens, Bulletin of Miscellaneous Information.—Additional Series X.:—Flora of Kwangtung and Hongkong (China). (370 pp.) London: Wyman & Sons, 1912. 4*s.* 6*d.* [58.19.]

Findlay, J. J.—The School, an Introduction to the Study of Education. (256 pp.) London: Williams & Norgate, 1911. 2*s.* 6*d.* net. [37(02).]

Deutsche Landwirtschafts-Gesellschaft.—Flugschriften. Heft 1:—Vorsicht beim Ankauf von Dünge- und Futtermitteln. (60 pp.) 1911. [63.604(*a*); 63.1626.] Heft 7:—Düngerfibel. (132 pp.) 1912. [63.16.] Berlin.

Long, H. C.—Weeds and their Eradication. (15 pp.) [Reprinted from the Journal of the Bath and West and Southern Counties Society, Vol. VI., Fifth Series, 1911–12.] [63.259(04).]

Somerville, W.—Agriculture. (256 pp.) London: Williams & Norgate, n.d. 1*s.* net. [63(022).]

Elkington, W. M.—The Small-Holder's Handbook: A Guide to the Management of Small Farms and Allotments; Dairying; Cultivating Arable and Grass Land; Bee-Keeping; Market Gardening, etc. (252 pp.) London: L. Upcott Gill, 1912. 3*s.* 6*d.* net. [63.191.]

Deutsche Landwirtschafts-Gesellschaft.—Arbeiten. Heft 200:—Gründüngungswirtschaften. (178 pp.) 1911. [63.165.] Heft 202:—Betriebsverhältnisse der deutschen Landwirtschaft. Stück XVI. (95 pp.) 1912. [63(43).] Heft 203:—Das Klettenlabkraut (Kleber) (*Galium Aparine*, L.) (29 pp. + xi. plates.) 1912. [63.259.] Heft 204:—Ungarische Reisebilder. (95 pp.) 1912. [63(436).] Berlin: Paul Parey.

Denmark.—Katalog over den Kongelige Veterinærog Landbohojskoles Bibliotek. Tillæg 1906–1910. (358 pp.) Copenhagen, 1912. [01.]

II. Internationaler Jagdkongress, Wien, 1910.—Vol. I.:—Organisation; Bericht über die Kongressberatungen; Exkursionsbericht. (244 pp.) Vol. II.:—Referate der Sektionen. (385 pp.) Wien: Wilhelm Frick, n.d. [06.]

Wisconsin Agricultural Experiment Station.—Research Bull. 19:—Effect of Heat and Oxidation on the Phosphorus of the Soil. (16 pp.) [63.113.] Research Bull. 20:—Factors Influencing the Availability of Rock Phosphate. (17–51 pp.) [63.1672.] Madison, Wisconsin, 1912.

Kraus, Dr. Gregor.—Boden und Klima auf kleinstem Raum; Versuch einer exakten Behandlung des Standorts auf dem Wellenkalk. (184 pp. + 7 plates + map.) Jena: Gustav Fischer, 1911. 8 M. [63.111.]

Maryland Agricultural Experiment Station.—Bull. 155:—Maryland Weeds and other harmful Plants. (71 pp.) [63.259(04).] Bull. 162:—The Quality of Seed. (235–242 pp.) [63.1951.] College Park, Maryland, 1911.

Memoirs of the Geological Survey of Great Britain.—Palæontology. Vol. I., Part 3:—The British Carboniferous Trepostomata. (135–195 pp. + iii. plates.) London: E. Stanford, 1912. 3*s.* [55:912.]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P. 10—9. 6,000. 6/12. R. C. & S., Ltd.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE

Vol. XIX. No. 4.

JULY, 1912.

THE FEEDING OF FARM STOCK.

CHARLES CROWTHER, M.A., Ph.D.
Leeds University.

PART VI.—RATIONS FOR PIGS AND HORSES.*

PIGS.

The essential features to bear in mind in the feeding of pigs are their relatively low powers of dealing with fibrous food-stuffs and their high powers of converting easily digested food-stuffs into meat. For these reasons pigs are fed almost exclusively upon milk, dairy wastes, potatoes, and meals. No animal responds more liberally to generous treatment in the matter of food-supply.

The food-requirements of growing pigs of the weights indicated are roughly as follows:—

Rations per 1,000 lb. Live-weight per Day.

Age (months).	Live-Weight per Head.	Total Dry Matter.	Digestible			
			True Albuminoids.	Starch Equivalent.	Oil.	Carbohydrates and Fibre.
	lb.	lb.	lb.	lb.	lb.	lb.
2—3	44	44	6·2	33·8	1·0	28·0
3—5	88—110	36	4·0—4·5	27·3—32·0	0·9	23·0—25·5
5—6	120—145	32	3·0—3·5	23·2—26·5	0·7	21·0—22·5
6—9	175—200	28	2·3—3·0	20·2—24·5	0·5	19·0—20·5
9—12	265—285	25	1·7—2·4	15·8—19·8	0·3	15·0—18·5

The lower limits apply to pigs that are to be kept for breeding purposes, whilst the higher limits refer to animals that are intended for disposal in fat condition by the time that they are mature.

For the first three weeks the young pigs will be entirely dependent upon the mother's milk, but this should afterwards be supplemented with gradually increased quantities of skim milk or separated milk, together with a little meal and boiled potatoes, given in three meals. The young pigs must, however, on no account be permitted to share the sow's food, or serious digestive troubles may be occasioned.

---

* This part of the article is largely based upon Leaflet No. 79, but much new matter has been included.

The safest single dry food for pigs for a few weeks both before and after weaning (also for sows suckling their young) is the class of wheat milling offal known commonly as "sharps." This should be of the very best quality. The more concentrated meals (barley, maize, peas, &c.) should only be introduced gradually, when the pigs are three to four months old, or stomach troubles may be occasioned and endanger the lives of the pigs. The best addition to the meals is skim milk, then separated milk, butter-milk, and whey. These should be given at first in small quantities, and afterwards increased up to the amount desired.

The following mixtures of food rations will serve for pigs fed from ten weeks old, for a period of eighteen to twenty weeks, and making from 130 to 145 lb. dressed weight. Each consists of food-stuffs ordinarily used in pig feeding to meet varying farm conditions, and contains digestible albuminoids and starch-equivalent in about the same ratio as in the "standard" rations. The daily allowance will be regulated by the age, size, and appetite of the pig.

a. 6 lb. of Maize Meal or 7 lb. Barley Meal to 1 gallon of Separated Milk
b. 2 ,, ,, ,, ,, 1 lb. of Pea Meal
c. 6 ,, Middlings to 1 lb. of Pea Meal and 6 lb. Barley Meal
d. 6 ,, Boiled Potatoes, 3 lb. of Ground Oats, to ½ gallon of Separated Milk
e. 5 ,, Ground Oats and Barley, 1 lb. Pea Meal to 1 gallon of Whey

The meal is scalded in bulk and mixed with separated milk, whey, or water as the case may be, at the time of serving. The pigs are fed three times a day with as much as they will "clean up" each time.

In the spring and summer a moderate supply of green food (clover, vetches, cabbage, &c.) is very advantageous. In winter a supply of turnips, swedes, mangolds, cabbage, &c., will serve the same purpose. The potatoes should always be well boiled or steamed, but this treatment is not necessary with other succulent foods.

In many parts of the country the most saleable pig is one weighing about 160 lb., or eight scores dead weight, giving a side of bacon of about 60 lb. in weight. This should be attained when the animal is about eight months old. The pigs are weaned at about two months, and for the next three months are kept in rapidly-growing store condition. They should be given cooked potatoes, roots, or vegetables of some sort every day, and in addition should receive a thin wash comprising a fair proportion of albuminoids. Salty refuse from the dairy or house must on no account be given to pigs.

The following are examples of suitable mixtures of foods for pigs after weaning:—

(1) Separated milk or butter-milk, barley meal, and bran or pollards. If one gallon of separated milk be allowed, the meal and bran should be mixed in the proportion of 5 to 1.

(2) Separated milk or butter-milk, maize meal, and bean or pea meal. With one gallon of separated milk the maize and bean or pea meals should be in the proportion of 4 to 1.

(3) Separated milk or butter-milk, maize meal, and wheat meal, the meals being in the proportion of 3 of maize to 1 of wheat.

(4) Whey or house wash, barley meal, and bean or pea meal. With one gallon of whey the meals should be in the proportion of 2 to 1.

(5) Whey or house wash and ground oats.

(6) Brewers' grains (fresh), barley meal, and bran or pollards.

Compared with whey, separated milk and butter-milk are both rich in flesh-forming constituents (albuminoids). A mixture of whey and maize meal would be quite unsuitable unless fortified by, say, bean or pea meal.

Attention must be given to the supply of lime and phosphates in the food of growing pigs. As a rule the milk and meals supply all the phosphate required, but there is often a deficiency of lime. This can be made good by small additions of precipitated chalk, increased gradually up to ¼ or ½ oz. per day.

With regard to the quantity of food required, young pigs of three or four months old will consume about 3¾ lb. of dry food per 100 lb. live weight per day. This quantity of dry food would be supplied by one gallon of separated milk and about 3 lb. of meal.

After pigs have attained the age of about five months the feeding is of a more forcing nature, and the amount of exercise restricted. From this time the fattening process continues till the animals are slaughtered at the age of eight or nine months. The quantity of food required is represented by about 3½ lb. of dry feeding substance per 100 lb. live weight per day, and in order to produce a fair proportion of lean flesh the diet should have an albuminoid ratio not wider than about 1 to 6. The allowance of meal should be gradually increased, and the food should be given of thicker consistency as the fattening proceeds. A pig of 160 to 180 lb. live-weight will require about 6 lb. of meal per day, or its equivalent in meal and dairy refuse. The following are suitable daily rations for pigs of this kind:—

(1) 5 lb. barley or maize meal, 3 lb. potatoes, 1 gallon separated milk or butter-milk.

(2) 6 lb. barley or maize meal, 1 gallon separated milk or butter-milk.

(3) 4 lb. barley or maize meal, and 2 lb. bean or pea meal.

(4) Equal quantities each of bean, maize, barley, and wheat meals.

(5) Barley and wheat meals in the proportion of 5 or 6 of the former to 1 of the latter, with separated milk or butter-milk, and in the proportion of 3 or 4 to 1 with whey or wash.

Well-bred pigs slaughtered at, say, eight or nine months old will usually weigh about 200 to 212 lb. live-weight, and they will yield 75 to 80 per cent. of carcass meat.

It is considered that a pig thriving well should yield about 1 lb. of dressed meat for every 5 lb. of meal consumed.

In London and the South of England fattened pigs weighing when dead from 60 to 120 lb. ("jointers," "porkers," or "porket pigs") find the readiest sale at best prices. Such pigs are fattened as they grow from the age of about three months onwards, and are fat when about sixteen to eighteen weeks old. This is undoubtedly the most profitable system where the fattened porkers can be readily disposed of at fair prices, since the cost of production of any form of meat, other things being equal, steadily increases with advancing age.

Pigsties should be kept clean, warm and dry, as the pig is very susceptible to cold or damp.

A brood sow will largely provide herself with food if allowed the run of a grass-field, but it is advisable, especially during the last month of gestation, to add some more concentrated food such as maize, peas, or beans that have been soaked in water for at least twenty-four hours. Bulky food should, however, be avoided. After farrowing she will require a liberal supply of nutritious food, which may consist of sharps, maize, boiled potatoes and skim milk.

HORSES.

For general principles see Vol. XVIII., p. 988.

In feeding horses it is essential to remember that, compared with cattle, the horse has only a very small stomach, which acts most efficiently when about two-thirds full. The horse is thus not well adapted for dealing with bulky food, and should receive its food at regular short intervals, if possible not more than five hours being allowed to elapse between meals during the daytime.

The ration of the working horse must hence contain a large proportion of concentrated food, the most suitable being oats, barley, maize, beans, and peas. A ration composed exclusively of concentrated foods will not prove satisfactory, but must be blended with a certain amount of bulky food. This latter must consist of hay or good straw.

It is economical to chaff hay for horses, as they frequently waste it by littering when supplied long in the rack, though possibly a horse given to bolting food would chew it better in the long state. In general, however, if the greater part of the hay is chaffed and mixed with the grain food, a thorough mastication of the latter will be ensured, the mastication will be effected more rapidly, and waste of hay will be reduced to a minimum. Long hay may be placed in the racks for consumption during the night.

The proportion of hay and straw in a horse's ration should be regulated by the demands made upon it for work. During busy times, when horses are working long hours at heavy work, the diet should be of a concentrated character, as horses do not derive the same amount of nourishment from bulky foods that cattle do. In the neighbourhood of London, where farm horses are frequently engaged almost continuously in carting hay and straw to market, it is not unusual to allow as much as 25 lb. per head per day of oats, with only a small quantity of hay chaff.

Of the grain foods, none is superior to oats, and for the more valuable horses they are commonly regarded as indispensable. Barley and maize may be used with safety if blended with oats, beans, or peas. They are more suited, however, for horses working at a slow pace than for those in rapid motion.

Beans are favoured for horses that are called upon for sudden exertion or prolonged heavy work. All corn should be crushed or bruised. Sugar also seems to be an energy-producing food of the first rank, and may be conveniently supplied in the form of treacle.

All the hay and grain used must be thoroughly mature and "sweated." In feeding horses it is a safe rule to remember the saying "*old* oats, *old* hay, and *old* beans long crushed."

The following data as to food-requirements may serve for guidance in constructing rations for horses under various conditions. The "medium work" may be taken as similar to that done by a horse ploughing medium loam soil for a day of eight hours.

The data given are the requirements per 1,000 lb. live-weight per day. Ordinary heavy carthorses will weigh more than this, say 1,250 to 1,500 lb., and the rations must be increased for them correspondingly by about ·2–·3 lb. digestible albuminoids and 2–3½ lb. starch-equivalent.

Rations per 1,000 lb. Live-weight per Day.

	Total Dry Matter.	True Albuminoids.	Starch Equivalent.	Crude Albuminoids.	Oil.	Carbohydrates and Fibre.
	lb.	lb.	lb.	lb.	lb.	lb.
At Rest	17—22	0·6	7·0	0·8	0·2	9·0
Light Work ..	18—23	1·0	9·2	1·2	0·4	9·8
Medium ,, ...	21—26	1·4	11·6	1·6	0·6	11·3
Heavy ,, ...	23—28	2·0	15·0	2·2	0·8	13·7

The maintenance requirements given for a horse at rest correspond to a supply (per 1,000 lb. live-weight) of about 8 lb. of digestible matter, with an albuminoid ratio of about 1 to 8. These requirements can be met by good hay alone. Such a diet, however, fails to keep up that "hard" condition which is necessary if the horse is to be fit for work when called upon. A suitable ration for an idle horse is:—

1.—8 lb. Oat Straw
6 ,, Hay
5 ,, Maize (or Maize and Barley) } or 8 lb. Oats
2 ,, Beans }

Carrots, swedes, and mangolds are much relished by horses; they are very suitable for idle horses, but to those in work they should not be given in quantities greater than about 8 or 10 lb. a day. A sick horse will often be tempted to eat a few carrots when it will touch no other food.

From the above table it would appear that a heavy farm-horse at ordinary work will require a ration supplying about 25 to 30 lb. total dry matter, with a starch-equivalent of about 14 or 15 lb., including about 1¾ lb. digestible albuminoids.

The following is probably the simplest example of a daily ration for a farm horse:—

2.—20 lb. Hay
12 ,, Oats

As a rule, however, a simple diet like this is not the most serviceable. Occasional changes of food are advantageous. With a more complex diet the animals will be found to thrive better, and in many cases also the expense is reduced.

A mixture of maize and beans in the proportion of 2¾ of the former to 1 of the latter gives about the same albuminoid ratio as oats, and it will be found that 15 lb. of the maize-beans mixture affords the equivalent amount of nourishment to 19 lb. of oats.

The following are examples of suitable daily rations for farm horses at average work:—

3.—18 lb. Hay
8 ,, Maize, or partly Barley
2 ,, Bran
1½ ,, Beans

4.—12 lb. Hay
5 ,, Oat Straw
6 ,, Oats
5 ,, Maize
2 ,, Beans

5.—18 lb. Hay
12 ,, Oats
1½ ,, Beans

A full ration for a heavy horse at the busiest time of the year would be:—

6.— 9 lb. Oat Straw
6 ,, Hay
12 ,, Oats
3 ,, Beans or Peas
1½ ,, Linseed

Farm horses fed on oat straw and oats alone—the plan followed in many northern and western districts—require a very variable quantity of oats, depending upon the character of the straw, which in some localities has a high nutritive value, whilst in others its quality is very low. In any case the oat straw is given *ad libitum*, and the quantity of oats required to supplement it will vary from 14 to 24 lb. according to the quality of the straw, the quality of the oats, the size of the horse, and the character of the work to be done.

Mares suckling foals find all the nourishment they require in an early summer pasture. Should an indoor ration be required for a mare with a foal, the following is a very suitable one.

7.—21 lb. Hay
4 ,, Maize Meal
5 ,, Oats
3 ,, Bran
3 ,, Beans

Half the hay might be given long, and the other half should be chaffed and mixed with the maize meal and bran damped, and the oats and the crushed beans given dry.

The foal will graze with the mare and soon share with her any indoor food she may be getting, and thus prepare itself for weaning. When weaned (about five months old) it should get a little trough food, consisting of ½ lb. oats, and ¼ lb. linseed cake, a day. It would probably be wintered out on the pastures in the daytime, but in most parts of the country it will be desirable to house the foal at night in a shed or well-aired loose-box.

During severe weather it should be fed twice or three times daily, and, in any case, when brought in at night it should be supplied with a rack of hay and one of the following trough mixtures:—(1) 1 lb. of oats and ½ lb. linseed cake, or (2) ½ lb. oats, ½ lb. bran, and ½ lb. crushed beans. The oats should be crushed or bruised.

Bruised oats, bran, cut hay and pulped turnips moistened with treacle and water, make an excellent mixture. A hot mash of bran, beans, and hay is also productive of good results.

Except in very bad weather, foals are much better running out during the day than kept in confinement, not so much for the sake of the food they find as for the exercise, which is so essential for the normal development of the body and limbs.

During the winter of its second year the colt may be gradually introduced to light work, say about three half-days a week, and during the following autumn it may be fully broken in to the heavier work of the farm. On no account, however, must the young horse be overworked, or irreparable damage may be done to the slowly hardening framework of its body.

THE IDENTIFICATION AND ERADICATION OF SOME COMMON WEEDS.

IV.*

HAROLD C. LONG, B.Sc. (Edin.).

With Drawings from Nature by BERTHA REID.

WILD CARROT.

THE Wild Carrot (*Daucus Carota,* L.) is a weed common to both arable and grass land, though it seems to be chiefly associated with dry calcareous and loamy pastures. In an examination of the flora of certain districts in Wiltshire and Somersetshire, Brenchley found that this weed is confined to chalk and is symptomatic of it.† Bentham and Hooker remark that it is "common in Britain, especially near the sea." The cultivated carrot was derived from the wild *Daucus Carota,* and the two are strikingly similar in the earlier stages, while the scent and flavour are only more pronounced in the former. The Wild Carrot is either annual or biennial.

Fruits.—The fruits of Wild Carrot are prickly, the larger prickles being rather flattened at the base. The separate portions (mericarps) or "seeds" (Fig. 1, *a*), are oval, flattened below, rather arched above, with five inconspicuous longitudinal ribs bearing short hairs or bristles, and four secondary ribs, which are winged and fringed with a single row of flattened whitish or whitish-brown barbed spines or prickles, which are rigid and easily broken, and may be missing when the fruits are found in seed samples. The ribs probably secure dispersal by the wind, while the spines serve to protect the fruit, and to secure dispersal by adhering to passing objects. These "seeds" are greenish-grey or greyish-yellow in colour and average $\frac{1}{12}$ in. to $\frac{1}{9}$ in. (2 to 2·8 mm.) in length. They have a smell somewhat reminiscent of aniseed, and a rather bitter taste. Harz says that 200 large "seeds" weigh 0·988 gramme. The fruits occur commonly in clover and grass seeds, and when particularly plentiful are held to point to seed of mid-European origin. They perhaps chiefly occur in samples of red clover, alsike, trifolium, dogstail, and Italian ryegrass seeds.

---

* The previous articles appeared in the *Journal* for July, 1911, p. 288; September, 1911, p. 460; and December, 1911, p. 748.

† *Journal,* April, 1912, p. 26.

Seedlings.—In the very young seedling (Fig. 1, *b*) the root is long, slender and thread-like; the hypocotyl is thicker than the root, whitish below but tinged with red just below the cotyledons, and smooth. The cotyledons are light green, linear and very narrow (narrowest below), ⅓ in. to ¾ in. (8 to 19 mm.) in length, with midrib showing above and beneath; they are somewhat convex as regards the basal half but flattened in the upper portion.

In the second stage seedling (Fig. 1, *c*) the root is extending, and fibrous; the cotyledons have attained to 1⅜ in. (34 mm.) in length but are only 1/15 in. (1·7 mm.) broad at the widest part, while they stand well upwards and outwards, but are curved. The leaves are radical and long-petioled; they are twice trifid, with the lobes themselves cut and lobed, hairy and dark green. The petioles are deeply channelled above, convex below, hairy, and green or tinged reddish.

The third stage seedling (Fig. 1, *d*) closely resembles the second stage, but is larger and the foliage is more finely divided.

Mature Plant.—The Wild Carrot (Fig. 1, *e*) is either an annual or biennial, and has a tough, hard tap root, rough bristly stem, with few pinnate leaves cut into many small fine leaflets. The umbel consists of many small flowers, those at the outside of the umbel being white, while those towards the centre are reddish-purple. In the fruiting stage the partial umbels are of different heights and impart to the whole umbel the form of a cup-shaped bird's nest, giving rise in some localities to the name Bird's Nest. The flowers open from June to August. According to *Morton's Cyclopaedia of Agriculture* (1856, Vol. II, p. 1116) a single plant may produce 600 flowers, or 1,200 seeds; while Dorph-Petersen puts the number of seeds for a single plant at 4,000 to 110,000.*

Prevention and Remedy.—Since this weed is an annual or biennial, it may be effectively combated by two measures, the one consisting in frequent cutting to prevent seeding, and the other directed to the use of pure seeds to prevent its re-introduction to the farm. On grass land an endeavour

---

* *Mitt. der Deut. Land. Gesell.*, Dec. 12, 1906, p. 474.

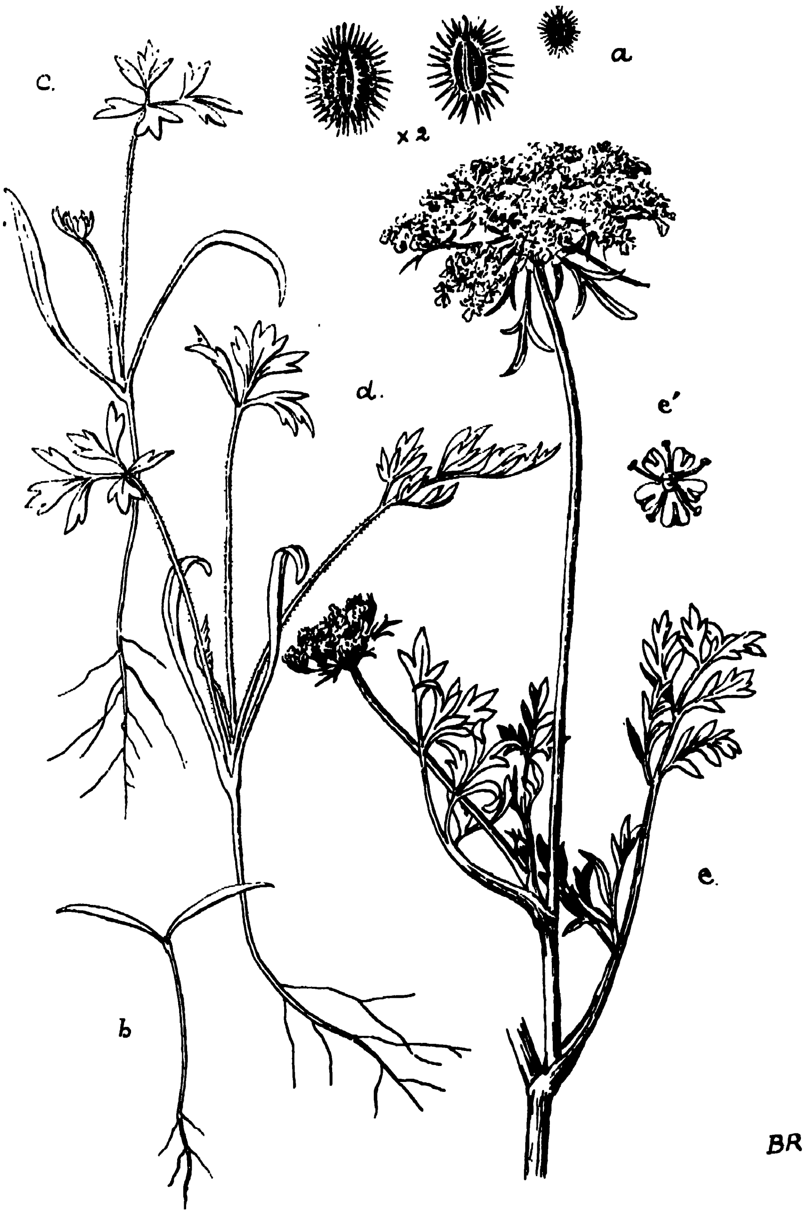


FIG. 1.—WILD CARROT (*Daucus Carota*, L.).

a, Fruit, nat. size and × 2; *b*, early stage of seedling × 1; *c*, second stage of seedling × 1; *d*, third stage of seedling × 1; *e*, flowering portion × 1; *e′*, flower magnified.

should be made to improve the general condition of the pasture or meadow concerned; regular cutting and spudding should be practised to prevent flowering and seeding. In the United States and Canada ploughing up is recommended; for example, it is suggested by the Canadian Department of Agriculture that "old meadows infested with it should be broken up and cultivated for a few years";* and by the Ontario Agricultural College that "when the field becomes badly infested it should be ploughed and cultivated and treated to a hoed crop"; † while the United States Department of Agriculture suggests "grubbing in the fall; cultivation." § The first-named authority states that sheep will suppress the weed in pasture land, and as they readily eat it this is doubtless true, as it is not perennial.

On arable land the recommendation as to pure seeds and repeated cutting—hoeing and other tillage operations—to prevent seeding, will be effective.

SHEPHERD'S NEEDLE.

THIS weed (*Scandix Pecten-Veneris*, L.) is also commonly known as Needles, Crow's Needles, Beggar's Needle, Needle Chervil, and Venus' Comb, owing to the peculiar long, sharp fruits. It is an annual weed of arable land, particularly cornfields, and occurs especially on light chalky soils. A friend informed the writer that in North Lincolnshire it is found exclusively on the Chalk formation, and not on the Oolite. "Needles seem to favour the thinner soils on chalk, and come in any corn crop, autumn or spring sown. Not troublesome on the *strong* land, which runs in some places in valleys or on the edge of the chalk."

In the investigation on Wiltshire soils referred to above, Brenchley found that the Shepherd's Needle is very characteristic of the chalk, only very occasional on clay and heavy brashy soils, and scarce on the Bake—a thin soil on the top of the Downs which is destitute of lime, and sandy and acid in nature. Bentham and Hooker refer to this species as "Frequent as a cornfield weed in England, Ireland, and the south of Scotland, but decreasing further northward."

---

* *Farm Weeds of Canada*, 2nd edition, 1909, p. 118.

† *Weeds of Ontario*, Ont. Agric. Coll., Bull. 188, 1911.

§ *Farmers' Bulletin*, No. 28.

This weed is sometimes exceedingly troublesome, and it seems probable that the seeds may lie dormant for a time. William Pitt remarked in 1806 that the weed "seldom abounds in well-managed land," though "sometimes abounding in hard tilled land." *

Fruits.—The fruits (Fig. 2, *a*) of Shepherd's Needle consist of two one-seeded carpels, and are linear, cylindrical, and prolonged into a slender, elongated, smooth, flattened beak, usually dividing and curving when ripe, and varying from 1 to 2 in. (25 to 50 mm.) in length. The whole fruit has been likened to the tooth of a comb, and also to a thick needle. The single carpels, or fruits proper (the "seeds"), at the base, are ¼ to ⅜ in. (6 to 9 mm.) long, channelled on the inner surface, and bear five ribs. The ground colour is very dark brown to blackish, the ribs being light brown, and the whole convex surface of the fruit is covered with minute forward-directed spines, as also are the margins of the split beak, making it rough and clinging to the touch when rubbed in one direction but smooth in the other.

The "seeds" are, according to Burchard,† found in grass-seed and sainfoin samples of European origin. Holdich‡ remarks that "the seeds are long and bent, of a rough texture and brown colour. They are seldom seen in samples of wheat, being a little too short of growth; but barley, being mown, must necessarily be infested if they be in the crop, for no dressing can separate them." This reference to the plant being too short of growth in the case of wheat doubtless refers to the fact that when Holdich wrote wheat was *reaped*, and cut off well above the ground. Cleaning of farm seeds has progressed much since his day.

Seedlings.—The very young seedling (Fig. 2, *b*) has a very slender, whitish root; the hypocotyl is slender, whitish towards the base, but dark reddish or brown above, and smooth. The cotyledons (Fig. 2 *b'*) are linear and very narrow, short at first but elongating considerably; they are ⅖ in. to 1 in. (10 to 25 mm.) long and $\frac{1}{40}$ in. to $\frac{1}{30}$ in.

---

* *On the Subject of Weeding*, Commun. to the Board of Agriculture, Vol. V., 1806.

† *Die Unkrautsamen*, Dr. O. Burchard, 1900.

‡ *An Essay on the Weeds of Agriculture*, Benjamin Holdich, edited by G. Sinclair, 3rd edition, 1825.

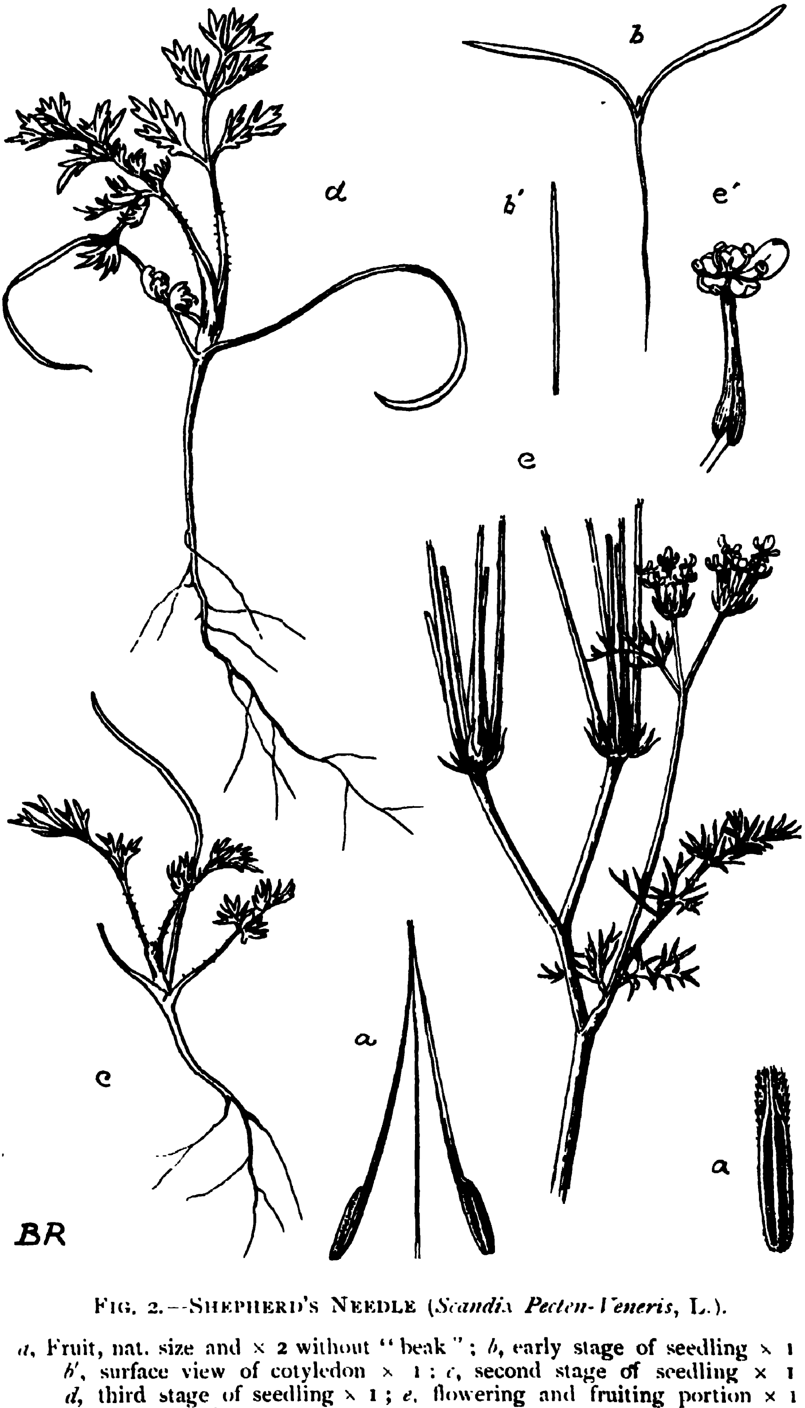


FIG. 2.—SHEPHERD'S NEEDLE (*Scandix Pecten-Veneris*, L.).

a, Fruit, nat. size and × 2 without "beak"; *b*, early stage of seedling × 1 *b′*, surface view of cotyledon × 1 : *c*, second stage of seedling × 1 *d*, third stage of seedling × 1 ; *e*, flowering and fruiting portion × 1 *e′*, flower magnified.

(0·6 to 0·8 mm.) broad. They are light green in colour, smooth, with a midrib down the centre clearly showing below, and they stand almost V-shaped at first, later assuming a nearly horizontal position.

In the second stage seedling (Fig. 2, *c*) the cotyledons have attained their maximum length, perhaps 1½ in. The first leaves are radical, on long, slightly hairy petioles which are channelled above and convex below, rather dark green, smooth, and twice pinnate, with the lobes themselves cut and lobed.

The third stage seedling (Fig. 2, *d*) closely resembles the second, but is larger, with more leaves, which are more freely cut. The stem is now about to be sent up.

Mature Plant.—The full-grown plant (Fig. 2, *e*) is 6 to 18 inches high, and the stem is branched; the leaves are few and much divided, being "twice or thrice pinnate, with short segments cut into narrow lobes"; the umbels of small white flowers are terminal, and the flowers open between June or July and September, giving rise to the fruits already described.

Prevention and Remedy.—Since this weed is an annual, the object should be to prevent the plants attaining maturity and scattering their seed. In corn crops the weed may need to be hand-pulled in late spring, but as it is so short this may not be possible after the cereal is 18 inches high, and is too expensive where large areas are concerned. It seems to be of sufficiently early growth in spring for much of it to be destroyed by surface cultivation, and with this object a late turnip crop may be taken. Where the weed is very plentiful two root crops in succession may effectively reduce it.

PREPARATION OF WILLOWS FOR MARKET.

W. PAULGRAVE ELLMORE AND THOMAS OKEY.

THE preparation of willows for market consists in buffing, peeling, drying, and tying up the rods into bundles.

BUFFING.

Buff rods are produced by boiling freshly-cut rods, or rods which have been left to dry in their skins, and then peeling them.

Varieties suitable for Buffing.—In order to meet the large demand usually experienced in autumn for buff rods, it is essential that growers should plant several varieties, ranging from Pomeranians to Mauls or Mottled Spaniards. Spring winds quickly dry exposed stacks of green willows, and the grower should, if possible, boil the varieties with the thinnest skins first, such as most of the *triandras*. The Black Maul and New Kind, having thicker skins, will remain green up to the end of March or April, and *Salix hippophæfolia* will buff well up to May. These rods have the thickest skins, and if need be can be peeled when the bark has dried by placing them in cold water at the commencement of the boiling, if due care has been taken to ensure that the bundles dried without the rods heating in places.

The varieties of *Salix viminalis,* with the exception of Long Skins, do not make valuable buff; they, too, may be left until late in the season, since by reason of their good quality the rods leave the boiling tank with sufficient colour to be stacked as soon as dry.

With a few exceptions the *purpurea* varieties are seldom used for buff, owing to the absence of tanning properties, and the only sorts in large demand are Light, Dark, and Old Dicks, and Kecks. The Light and Old Dicks are eagerly sought after for all articles requiring a small, long, and tough taper rod. The Dark Dicks, being of a larger growth, generally provide stakes or skeins, but in the event of their not growing large enough the Kecks are the only other variety suitable to supplement them.

Each of these sorts is best left until the early spring, when the sun begins to exert its influence and materially assists in developing the desired light-golden colour. In the absence of sun it is often necessary to expose these willows on the grass for from two to three weeks, turning them over during that period several times in order to get the required colour and to prevent mildew or black spots appearing, for both those defects materially reduce the market value. If the season is a dry one the rods should be sprinkled with a fine spray of water; sun and air will then produce the necessary colour. It is most desirable that an equal colour be obtained all through the output, and since the sun plays such an important part in producing this, the exposure need not be so long during the later weeks of the peeling as in the earlier part of the season when there is less sun and light.

The whole of these varieties should be boiled in the green state, and peeled by the fingers, so as to prevent splitting, which would destroy their value.

Time of Cutting.—Cutting the crop for buffing can be started as soon as half the leaf has fallen, *i.e.*, usually about the third week in October. After the leaf has entirely fallen the rods are quite ripe, and may be stacked out of doors without harm in stacks of any size.

Boiling.—Every effort should be made to complete the buffing before the bark dries, and if through any cause the bark sets, it will be necessary to put the rods in cold water and then boil as directed for green.

The boiling tanks must be of varying sizes, unless the grower specialises in a certain kind of willow, and should vary in size with the number of peelers employed, four on each side being as many as can work on general rods to advantage. Eight or ten peelers will empty in one day a tank 12 ft. by 4 ft. 6 in. by 4 ft. 9 in. deep inside. Such a tank will hold about 30 cwt. of ordinary green one-year-olds, which when peeled and dried give 10 to 11 cwt. of buff, and will also be found a useful one for sticks.

In the case of Dicks or any other small-growing varieties a tank 7 ft. 6 in. long by 24 in. wide and 24 in. deep (inside measurements) is large enough.

For the small grower the following inexpensive and simple arrangement will suffice:—Having decided on the size of tank, the flue should be run underneath the centre for the full length of the tank, and turned at the end so as to pass along the side and across the front above the furnace door and then along the opposite side and up the chimney. By this method the maximum amount of heat will be obtained before the smoke ascends the chimney. The tank should have an inside flange at the top in addition to an outside one, in order to keep the wooden sinkers, which hold the rods under the water during the process of boiling, in their places.

All the rods in the tank should be peeled by four o'clock in the afternoon, which is as late as the peelers can see in the winter; then the fire should be got up and the water made to boil. This done, the tank should be packed with willows in the closest possible manner, with a view to economy in fuel; some of the peelings should be placed on the top to keep in the heat, and the wooden sinkers fixed across under the flange to keep all the bundles immersed. They should be kept on the boil for about five hours; the fire should then be banked up and left until the following morning. The fire should have attention an hour before starting-time for the full staff, so that the water can be heated in readiness for the peelers.

The usual practice is to put the bundles of willows into the tank just as they are cut, provided they are well-grown and free from rubbish, so that the peelers (usually women) get about an equal share of all sizes.

The simple method of boiler-setting described above will be found equally good in the case of a much more extensive buffing plant. In one case a range of four large tanks and one small one was heated by means of a 12 h.p. Cornish boiler, which not only provided the steam for boiling the water in each tank, but also pumped the cold water for filling and furnished the heat required for drying the buff.

The coils of copper piping that lie along the bottom of the tank should be hinged, so as to allow them to be raised up either from the end or side for the purpose of removing the sediment which accumulates between the pipes and on the bottom of the tank. Attention to this matter will be amply rewarded by the brighter colour and cleaner appearance of the buff. The object of placing flues underneath is to afford another means of heating in the event of the steam boiler going wrong. Of the five tanks referred to above, only two had flues fixed underneath, and either or both of these could be fired at a less cost than putting steam on.

The average price for first quality growth of one-year-old green in the winter of 1911–12 was £5 per ton. Three tons of green are needed to make a ton of buff, and the cost of coal and labour, including a foreman at 30*s.* a week, at about £5 per ton, will bring the net cost of producing a ton of buff to £20. The various sizes of buff are selling readily at £24, £26,

£28, £30, and £33 per ton, an average of £27 per ton, or a profit of 33 per cent. per ton over the green price.

PEELING (*a*) FOR BUFF.

The various means adopted for peeling buff are, in our opinion, capable of great improvement. Some growers use a forked hand brake made either of wood or iron; when the rod is inside the two blades the peeler closes them with the pressure of his hand, and draws the rod through in the manner adopted for white peeling. When the green rods have been drafted into sizes before boiling, a more expeditious method is to have two pieces of wood, the bottom one fixed and the top piece hinged at the end of the bottom one, and worked by a spring suspended from above. Both pieces of wood are fitted with a strip of india rubber, about 15 in. long by ½ in. square. Two strong youths or men are required to work this brake, one of whom takes from eight to twelve rods in his left hand, and with the right rubs the butt ends together until he forces back the peel for 8 in. or 9 in. into the form of a rosette or knob; he then lays the butt ends (which have been relieved of their bark) inside the wooden jaws, brings the top section of the peeler down by the pressure of his foot on a cord, whilst the second man pulls the whole of the willows through, the peelings falling to the ground.

This system gives the quickest results, but saves little in cost owing to the higher wages paid to the men, who find the work very exhausting and have to be remunerated accordingly. The method we invariably employ is to have four women on each side of the tank, who lift two or three rods from the water, and with the right hand force the peel back for 4 in. or 5 in. to a button formation, then in one action draw the whole of the rods through the left hand—which retains hold of the peelings.

The rate paid for peeling buff by hand is usually 4*d.* to 5*d.* per bundle, according to the size of the crop, in a green state.* The "bundle" is 36 in. in girth, as measured with a strap about a foot from the butt end as the rods lie on the rack behind the peelers.

---

* If the rods are buffed dry, the price is increased so that the peelers may earn about the same money or more, since labour during the summer is in greater demand.

The peeled rods are then drafted into different lengths, any rough or badly grown rods being thrown out. In this task a wooden standard fixed on the inside of a tub sunk two-thirds into the ground is used. The first drafts, being the longest, are called No. 1, and vary from 6 ft. 6 in. down to about 5 ft. 6 in.; then follow No. 2, 5 ft. 6 in. to 4 ft. 6 in.; No. 3, 4 ft. 6 in. to 3 ft. 6 in.; No. 4, 3 ft. 6 in. to 3 ft.; and if any smaller are left (Nos. 5 and 6) they are usually put together.

Drying.—After boiling and peeling, the rods are exposed in the open air for a week or so to get the bulk of the water out and secure sufficient colouring.

The best system for drying in the open is to employ movable stands or "horses" made of wood, with wood rails 20 ft. long by 4 in. wide and 3½ in. thick laid from one horse to the next. The rods may stand with the butts on the grass or be laid across the rails, the object being to get the rods dry in the least possible time and to keep them uniform in colour. This can only be attained by turning the underside to the top when necessary, so that the whole of the rod may benefit equally from the sun and light. After such exposure the rods are brought into the drying room and laid on wooden racks, supported on rests, from floor to ceiling. This room should be fitted with a fan so as to exhaust the moisture, for without the aid of artificial drying it is almost impossible to buff on an extensive scale in winter time. Buffed willows are peculiarly subject to mildew, and if stacked away in a damp condition will soon turn mouldy and become spotted.

Even with the aid of heat-drying the bunching of buff should not be hurried during the winter months, since the atmosphere has a wonderful effect on buff rods, and if bunched tightly for export, even though the willows appeared to be perfectly dry when dispatched, they may be greatly damaged during a journey of any considerable length.

PEELING (*b*) FOR WHITE.

One of the writers on two occasions converted part of his boiling house into a forcing shed for white peeling in December, by making a wall 6 in. deep with brick and cement, thus forming a well in which several tons of green rods were placed on their butt ends in warm water, and since, as subsequently explained, it is necessary to change the water at intervals, an outlet for the waste water as well as an inlet was provided. By means of this warmed water, and by the aid of the steam from the buffing tanks, a flow of sap and growth of leaf rapidly ensued, and the rods were peeled in about three weeks. Where the boiling house is large enough this involves very little additional expense beyond the cost of the bricks and a length of perforated pipe to supply the warm water—which was easily drawn from the main supply to the buffing tanks. At the time of writing good quality English or French white willows are scarcely obtainable, even at the very high prices prevailing. Therefore, those growers who can adopt this method will be handsomely rewarded, and the whole of their crop will be sold before the usual time for whitening arrives.

Although much time and money have been expended on machines for peeling willows for white, it must be admitted that no very great advantages have been shown over the method in use fifty years ago. A photograph of the actual instrument then used will be found among the illustrations of brakes (Fig. 1) (1860). This instrument only peeled one willow at a time, as do most of the brakes in use at the present day. A firm at Thurmaston, near Leicester, however, now uses several patterns of brakes that will peel two rods at each operation. A machine invented by a Frenchman, and driven by power, which we tried in the peeling season of 1911, did not prove successful.

In the past, white peeling was paid for at a daily wage of 1*s*. 3*d*. to 2*s*. 6*d*., according to the experience of the workers. The tendency now is to adopt the more business-like method of paying by weight, which ensures the peelers a suitable reward for their labour. This pay in Leicestershire, Nottinghamshire, and Lincolnshire varies from 1*s*. per stone for the small rods (called Hullings), averaging from 3 ft. to 4 ft. long, to 5*d*. per stone for one-year-old rods above that size, and 6*d*. per stone for two-year-olds. In both cases it is customary for the peelers to sort out the small size from the one-year-old rods and pie them down, as subsequently described, and peel later. The small two-year-old rods are then dried for brown, because the undergrowth in a crop of two-year-olds is unsuitable for white staking on account of its deficiency in quality and size. The above wages may be regarded as liberal. It is by no means difficult to determine the weight by measuring the bundles with a strap.

The photograph marked "A" (Fig. 1) is of a machine worked by the foot operating the double jaws, which open when the treadle is pressed down. The peeling is gripped on four sections when being pulled through. If the rods are in good peeling condition the operator—by first putting the butt ends through the machine—will strip the entire brace of rods without the aid of a peeler. This machine in the hands of a capable person will peel more first-quality rods of medium size than any contrivance we know, and without splitting them.

Machine "B" (Fig. 1) also peels two willows at a time and does its work perfectly; it is constructed so that the peeling blades when worn can be easily removed and replaced. In its present form and make it is too expensive for general use. This (like all up-to-date machines) requires the operator to stand up to his work.

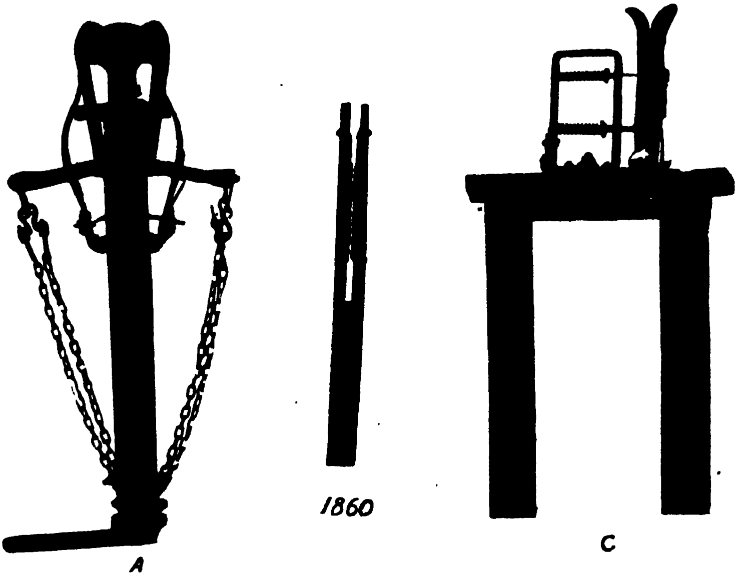
"C" (Fig. 1) is a German pattern made from a casting in two sizes. The larger is adapted for peeling two-year-olds or sticks.

"D," "E," and "F" (Fig. 1), all peel one rod at a time, and are, like those already described, fixed to a post stuck into the ground, and at the height desired by the operator. The rods to be peeled are placed on a stand at the side.

The increased return to the grower who whitens his own crop may be estimated according to present market prices as follows:—Three tons of one-year-old green at £5 a ton will produce one ton of white at a cost for labour of £4, *i.e.*, £3 6*s*. 8*d*. for peeling and 13*s*. 4*d*. for tying and other incidental expenses. Since white of all sizes together is now selling at £26 per ton, the profit is £7 per ton.

PREPARATION FOR WHITENING.

The several methods of preparation for whitening are known as cutting from the head, couching, pieing, and



A, machine worked by foot; will peel two rods at one time; *C*, machine adapted for peeling two-year-olds or sticks. The illustration in the centre is of an actual machine used fifty years ago.

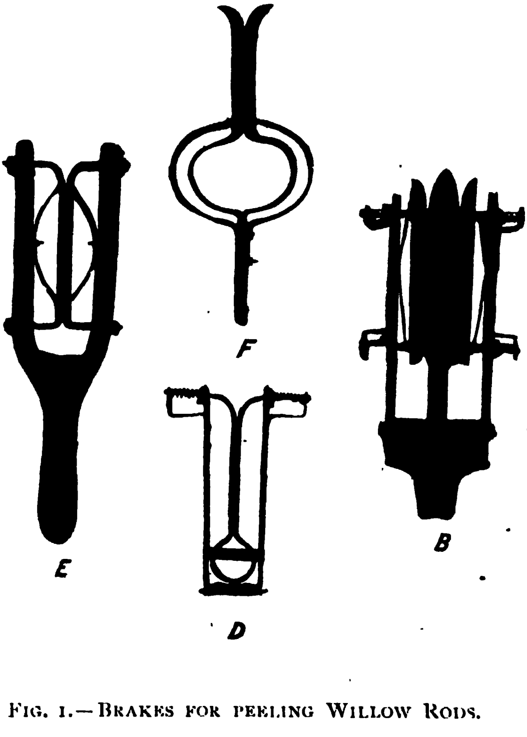


FIG. 1.—BRAKES FOR PEELING WILLOW RODS.

pitting. All are necessary in the case of growers on a large scale, whose object it is to start peeling at the earliest possible moment and prolong it as late as they can.

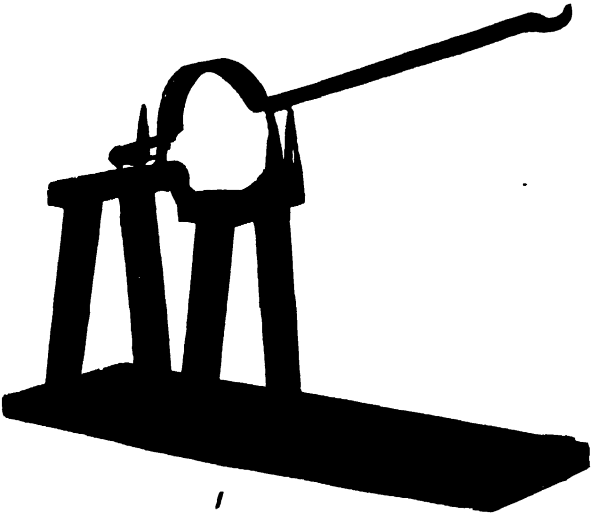
Cutting from the Head.—The first willows to peel will be those cut from the heads when bursting into leaf. The time between cutting the early and late varieties is frequently as much as from seven to ten days. The greatest care must be exercised in cutting in order not to allow willows to stand on the head until a new growth begins to form, as this produces a second skin, which shows itself when peeled in fine strips or shreds on the top of the old wood and presents a very ragged appearance when worked up. Such "double-skinned" rods are greatly depreciated in value and useless for good work; moreover, an exhaustion or bleeding of the head results. The correct period for commencing to cut from the head for white peeling cannot be determined by the calendar. It has been known to vary from March 10th to May 10th. The proper time is when the leaf begins to show or when the catkins appear, for the sap has then begun to flow. On many varieties the catkins appear before the leaf.

Couching.—At this time it is usual to cut a limited quantity for couching, which consists in laying a number of bundles of green on the peeling ground with the butts all one way, and then placing a similar layer on the top of these with the butts at about the centre of the bundles forming the underneath layer, repeating this until the stack is about six bundles deep. The object is to keep the tops from heating, and to permit the flow of the sap. It will be found a good plan to throw a liberal quantity of water over the whole to aid the sweating and prevent heating; then to cover the heap lightly with old peelings, which keep the willows warm and exclude wind and sun. By the time the material cut and peeled from the head is finished the contents of these stacks should be quite ready for peeling.

Pieing.—Some growers instead of couching prefer, if they have plenty of spare ground, to put only one bundle deep on the ground and then place the next bundle from 3 ft. to 4 ft. behind, so that the tops of the back bundles wrap well over the butt ends of the row in front—following this on until all are in the pie. The willows are then lightly covered over with peelings, and watered once or twice a week, according to whether the season is wet or dry. In this manner they will keep in a peeling condition for weeks. The small rods in the bundles must not be allowed to heat, and in order to avoid this it is as well to turn the bundles over if they are likely to lie for more than two to three weeks.

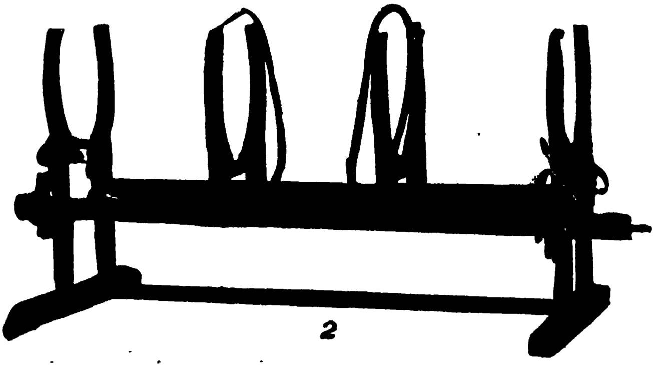
Pitting.—The other method, known as pitting, is to stand the bundles in a dyke in from 5 in. to 8 in. of water. The rods must not be tied too tightly; all butts must stand level, so as to be in the water, and light and air must be allowed to penetrate. It will be found a good plan to space the bundles into "bays" of six bundles by three or four, so that each bay will contain eighteen to twenty-four bundles according to their size. If the bundles do not exceed 33 in. round, twenty-four may be stood in each bay; but if they are 36 in. to 38 in., eighteen bundles will be found quite sufficient.

It is essential in pitting material that the water should not be too hard or too cold, and that fresh water should always be passing through. If the water is stagnant, the rods will make a satisfactory growth for a short time, and then remain in about the same state for a week or ten days. Afterwards they will gradually turn sickly and deteriorate, or frequently get covered with mealy bug and other insect life. If a constant supply of fresh water is maintained we have known rods to stand in the pit from March, which is the usual time to begin pitting, to the end of July, in a good condition, peeling having commenced late in May. Where the amount of available labour is limited, or the season proves to be wet and unsuitable for outdoor peeling, this method is a great advantage, and there is no fear of a double skin being produced. Even with a good sound bottom for the dyke it is a wise plan to rinse the dirt from the butt ends of the willows in clean water and allow them to dry somewhat before giving to the peelers. Otherwise the rods will be discoloured by the dirty hands of the peelers and proportionately reduced in value. The great consideration is a good colour, and, in order to obtain this, white rods ought not to remain out of doors more than twenty-four hours. In suitable weather all material peeled before noon should be warehoused the same night, and this can be made possible by thinly spreading it

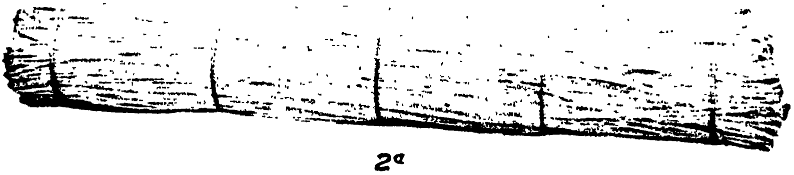


1

Machine for tying Willow Rods into Bundles.
The rods are " pricked in " round the band, so as to fill up every crevice.



2



2a

Fig. 2.
Machine for tying Willow Rods for Export.
It enables the bundles to be tied of equal size at each end, and also in the middle.
Fig. *2a* shows the style of tying adapted for export, with all tops protected.

on a couple of rails fixed 2 ft. from the ground, so that the wind can play underneath as well as on the top. The peelers must be taught to lay the rods between pegs, according to their various sizes—usually three, but sometimes four, according to the class of the rods.

TYING INTO BUNDLES.

The methods of marketing vary according to the district. Leicestershire has no standard size or weight of bundle, but sells exclusively by the cwt., including the bands. Some years ago 120 lb., or what was known as long weight, always used to be reckoned as a cwt., but the orthodox 112 lb. is now recognised. Nottinghamshire growers formerly tied and sold by the bunch weighing five stone = 72 lb. including bands, but that was a most unwieldy size for storing, and for some years now the growers have adopted the "half-bunch," weighing 35 lb. of rods (or sixty-four to a ton). One pound extra is allowed per half-bunch for the two bands, which are breeched. All growers in that county, as well as in the adjoining parts of Lincolnshire, quote at the present time a price per bunch of 5 st. of 14 lb. Those districts prepare and sort only into two sizes, called hullings and rods. Hunts. and Cambs., which produce varieties of a moderate quality and mainly of a large growth, sort into sizes, known as Tacks, Small, Long Small, Threepenny, Middleboro' and Great. These they tie by the aid of a special machine in bolts of 40 in. in girth, measured 8 in. for the smaller sizes, 10 in. for Threepenny and Middleboro', and 12 in. for Great, up the bolt from the butt. Rods are afterwards "pricked in" round the band, so as to fill up every crevice. (The machine is shown in Fig. 2 (1).) The grower quotes his price at per load of 80 bolts, the average weight of a load being about one and a half tons. But it is not an unusual thing for the weight of a load to vary by one-third, according to the quality of the rods, and to the season's growth.

Some few growers and merchants in these counties are now disposed to sell by weight, and no doubt this will, ere long, become the recognised method. Somerset growers tie up in bundles of 38 in., at 3 in. above the butts, and here again (with few exceptions) always quote a pricc per bundle.

Berkshire, which grows usually a good class of large stuff, ties its bolts 40 in. in girth at 10 in. above the butts, and quotes by the load. In Hunts., Cambs., and Berks. the actual growers frequently decline to do business unless the buyer will take the entire crop. This plan is very inconvenient, for it often happens that a buyer who has contracted to take the entire produce finds himself overdone with a size of material not well adapted for his particular class of work, and the makers of special goods are forced to purchase from rod merchants. The profits of these middlemen might just as well be enjoyed by the growers; as, indeed, is done by some in Berkshire, who quote by the bolt and thus extend the circle of their customers.

If, as is invariably the case, some part of every crop—especially the outside portion of the bed—is inferior or rough, it will be found best to lay such stuff on one side for brown, or, if peeled, tie it up by itself.

The export business, at one time of considerable value, has been much neglected in this country. The growers in Leicestershire and Notts., whose crops twenty years ago were frequently shipped as white, have for years sold their crops as green before Christmas for buffing. Consequently very limited quantities have been available for export. This trade has been captured by the Belgians, Dutch, and French—the two former supplying the cheap stuff, the last named the best sorts.

The tying machine (Fig. 2 (2)) was made especially for export tying, and is the only one known in this country. It enables a bundle to be tied of equal size at each end and also in the middle. This was found to be necessary because shippers would only carry rods by the measurement ton. The bundle (Fig. 2 (2a)) shows the style of tying adapted for export. It protects all the tops from injury. The steel peg and chain (Fig. 4) will be found a very efficient tool for tightening the bundle before putting on the willow band. Fig. 3 is also another very simple and efficient machine suitable for growers who are not expert tyers.

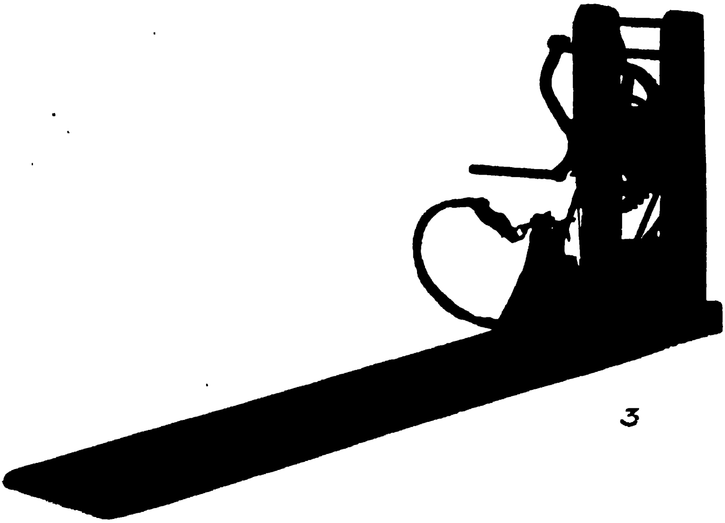


FIG. 3.—MACHINE FOR TYING WILLOW RODS.
A very simple and efficient machine suitable for growers who are not expert tyers

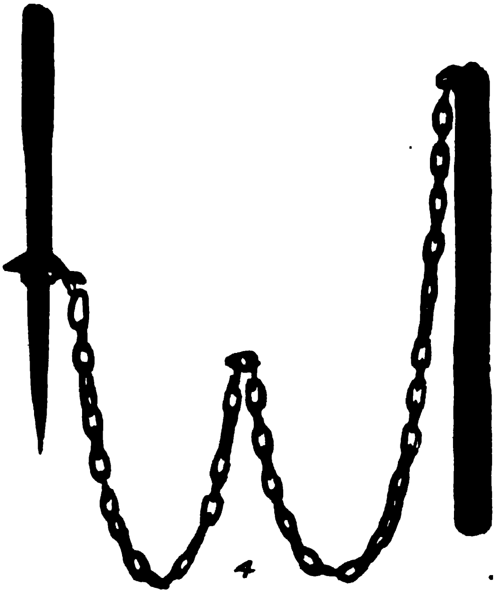


FIG. 4.
Steel peg and chain for tightening the bundle before putting on the willow band.

THE CONSTRUCTION OF PIGSTIES.

CONTRARY to popular opinion, no farm animal is really so clean in its habits as the pig, and probably none suffers so much if obliged to exist in wet, dirty, cold surroundings. In the case of all stock, any reasonable expenditure incurred in making them thoroughly comfortable is likely to be well repaid by the better return given for the food consumed, to say nothing of the prevention of those diseases which may arise from bad hygienic conditions.

The pig is an accommodating animal in many respects, but it is not fitted like other farm stock to withstand great changes of temperature; it is very sensitive to damp, and it may be said that pig-keeping is not likely to be a success unless warm, dry, fairly roomy, well ventilated sties are available. It is equally essential that the buildings should be so constructed that they can be easily kept clean, and disinfected from time to time. If these requirements are not satisfied, the most expensive and elaborate building will most certainly give poor results, while on the other hand, so long as these essentials are obtained, there is no reason why good results should not be obtained in the cheapest possible erection.

The common conception of a pigsty is the small low lean-to building opening into an open court. This type of erection has the important advantage of being cheap, but it has serious disadvantages. The only opening into the sty proper is usually so low as to necessitate creeping into it, a fact which militates against frequent cleaning, particularly in wet weather, while it is difficult to inspect the pigs except about feeding time; it is too small and in other ways unsuitable for sows with litters; the building as commonly constructed is dark, badly ventilated, and owing to the absence of a door is either too cold in winter or too close and hot in summer. Furthermore, if it is not required as a pigsty, it is of little use for anything else, whereas a small building, say 10 feet by 8 feet, about 5 feet high at the eaves, suitably lighted and ventilated, and provided with a door in two sections, would not only be much superior as a pigsty, but would be useful for other purposes, *e.g.*, poultry, storage of fuel, etc., if not required for pigs.

On farms it is doubtful if in ordinary cases, the erection of the common kind of sty is necessary or justifiable. As a general rule, all pigs except sows with litters, boars, and those nearly fat can be most economically and advantageously kept in the covered yards with fattening cattle. (It is necessary to say that for the comfort of the cattle the number of pigs should not be too large, and for the sake of the pigs themselves they should have a dry corner fenced off for feeding and sleeping. If the manure from the stables is thrown into the yard, it is important to see that it is well distributed, or the pigs will choose it to sleep in, and "cramp" or "rheumatism" will almost certainly follow.) For young litters, buildings of the loose-box type, opening and draining into the covered yards, or pens cut off from the yards by walls about 5 feet high, are most suitable, and can be used for a great variety of purposes when not employed as pigsties. There is no trouble with drainage or in the disposal of manure, provided the floors are well above the level of the manure in the yards.

Where pigs are kept in large numbers, accommodation such as that suggested is not sufficient, and special piggeries have to be provided. As already mentioned, the essential conditions required by pigs are warmth, dryness, sufficient room, and good sanitation, and so long as these are secured the arrangement and construction of the piggeries can, if desired, be regulated entirely by economy of erection and upkeep, and of labour involved in feeding and tending the pigs.

There are, however, certain essential conditions which should be secured in whatever kind of building is erected.

Situation and Aspect.—If at all possible, a fairly high and dry position should be selected, and in no case should the level of the floor be below the level of the surrounding ground, since buildings so constructed are almost certain to be damp and cold. The doorways, courts, windows, and openings should as far as possible be on the south side. Sties facing north may in some cases be unavoidable, but should never be used for young pigs, except possibly during the hot summer months.

Sties for boars, especially sties used for boars to which sows from other premises are sent for service, should be isolated from the sties in which other pigs are kept.

Floor.—This is in many respects the most important part of the building, and the part in which it is most difficult to combine conditions which are desirable from all points of view. For instance, for cleanliness, durability and cheapness there is no doubt whatever that a floor of concrete with a skin of smooth cement is the best. Such floors are, however, unsuitable for, at any rate, the sleeping quarters of pigs; they are always cold, and young pigs reared in houses with cement floors generally do badly, even if they do not develop cramp or rheumatism. Furthermore, if even slightly dirty they are as a rule very slippery. A compromise often made, is to have a cement floor, but to provide a movable wooden platform for the pigs to lie on, and this is good if the sty is roomy enough to allow of the platform being lifted frequently for cleaning purposes. Otherwise, dirt and manure will accumulate underneath. Probably a better plan is to have at least part of the floor laid with asphalt, or to make it of bricks set on edge in cement on a bed of concrete. Such floors are warmer than cement, give a much better foothold, and are fairly easily kept clean, though a slightly greater slope is required for efficient drainage.

Walls.—The walls must be weather proof, substantial and easily kept clean, and may be made of brick, concrete, or stone. Wooden walls can only be regarded as a makeshift, since with them it is impossible entirely to avoid cracks or joints in which manure lodges, while the junction with the floor is always a source of trouble, and unless protected by sheet iron or some such material, the lower part of the wall is gradually gnawed away by the occupants of the sty. If the wall is made of brick or stone, all joints should be smoothly pointed with cement, or, better still, the wall should be faced with cement to a height of at least 3 feet from the floor. When the sty is intended for breeding-sows, a rail, which is best made of iron tubing about an inch and a half in diameter, should be fixed about 10 inches from the floor, and the same distance from the walls, to protect the young pigs from being crushed. Partition walls need not be more than about 4 feet high, though in the case of a long building some should be taken up to the roof. In the case of extensive piggeries it is convenient to have some of the partitions so constructed that if required two or more sties can be thrown into one.

Roof.—The roof should be weather-proof and non-conducting, and may suitably be tiled, or boarded and covered with galvanised sheeting or thoroughly tarred felt.

In the case of lean-to sties, the roof should be not less than 4 feet 6 inches above the floor in its lowest part, and about 7 feet at the back. This is necessary in order to allow the sty to be thoroughly cleaned, and also to enable the animals to be examined and tended in case of sickness. It also ensures sufficient airspace and facilitates proper ventilation.

Airspace and Ventilation.—The airspace should not be so large that the buildings are cold, nor yet so small that, in order to secure efficient ventilation, draughts are unavoidable. Ventilation should be secured by openings in the wall and roof. Lighting, which is most easily done by panes of glass in the roof, should be sufficient. In order to avoid scorching of the pigs, the glass should be roughened and thick. Sunlight is a good and cheap disinfectant, apart from its direct effect on the health of animals.

Drainage.—Drainage is a most important point. It may be laid down as a general rule that there should on no account be a closed drain in any sty, and furthermore the drainage from each sty should be conducted separately to a main drain outside. The plan of draining a row of sties by one channel which passes through each in turn should never be adopted; the lower ones are apt to be wet and unhealthy, and if disease—*e.g.*, husk—breaks out in any sty, all the pigs below it are likely to become infected by means of the drain.

Troughs.—The simplest and best trough is made of glazed fireclay, semi-circular in section, and set in concrete. It should be set in the centre of a partition which, immediately above the trough, should consist of a hanging door supported on an iron rail. When hanging freely, this door is immediately over the centre of the trough, but it may be pushed inwards, thus completely shutting off the trough from the sty, or it may be pulled outwards, leaving the trough open to the pigs. The advantages of the system are obvious: the pigs can be fed, or the trough cleaned out, without the attendant entering the sty, while there is no chute where food is apt to lodge.

Courts and Runs.—Whether separate courts for the sties are provided or not, an extensive outdoor run is essential for sows and young pigs, and if possible a dry, sunny paddock should be provided for the purpose.

HOP GROWING ON THE PACIFIC COAST OF AMERICA.

ARTHUR AMOS, M.A.,
Department of Agriculture, Cambridge University.

III.

Systems of Stringing.—The stringing on the Low Trellis has already been explained.* On the High Trellis many different systems are in use. Perhaps the simplest is one in which the string wires run down the centres of the alleys; two strings are tied below to cedar pegs or to last year's straps, and above to the string wires, one string on either side. In another method the string wire is placed vertically above the hills, and the two strings from each hill are both tied to the wire vertically above the hills. In a third method, three strings are tied to each hill in such a way that the bines are distributed in a manner similar to our "Umbrella" system. Lastly, I saw one garden strung after the manner of our "Butcher" system, but with the middle wire raised to a height of seven feet, so that the horses can pass under it for cultivation.

Whatever be the system adopted for the high trellis, the strings are always very upright, so that the bines have little difficulty in climbing, and hence there is need of but little training.

The string which is employed in the Pacific Coast hop-yards is very different from the cocoanut string used in England. It is usually made of cotton, though jute is sometimes employed. Cotton and jute are both much stronger than cocoanut string, and hence much finer string may be employed without risk of breaking, but the saving in weight is counterbalanced by the extra cost of the string, and the growers have to be as economical as possible in its use. It has been found that the greatest strain on the string is always upon that part of it which is close to the top wire, especially when the tip of the hop shoot fails to reach and grasp the top wire, whilst the strain upon the lower part of the string is much slighter. In view of these facts each hop string is composed of two parts, the upper part, about 3 or 4 ft. long, being stouter and having a breaking strain of from 60–80 lb., whilst the lower part, from 10–12 ft. in length, is much slighter, with a breaking strain of only 15–20 lb.

---

* *Journal*, June, 1912, p. 194.

The strings are cut and joined together in preparation for stringing during the latter part of the winter.

The amount of string required varies from 20 to 40 lb. per acre, according to the height of the trellis and other factors. The price amounts to 10*d.* or 1*s.* per lb., so that the cost per acre will vary from about 20*s.* to 40*s.*, a cost comparable to that of cocoanut string as used in the English hop gardens.

Methods of Fixing the Strings.—There are two methods employed. In the first or "schooner" method, a platform is built upon a waggon, and upon this platform two or more men stand and tie the strings to the wires, whilst the "schooner" is drawn down the alley by horses. In the second method the wires are dropped down from the hooks (as previously described), and the strings are tied to them by men on the ground. Then the wires are hooked up again and the strings tied to pegs at the hills, or to the straps in the ordinary way.

Training.—Training begins during May in all districts, and it is a very curious fact that growth begins in British Columbia before it does in California, and to such good purpose that by June 1st hops are often near the top of the strings in British Columbia, whilst in California they may be scarcely half-way up. From this point, however, the Californian hops go right ahead, and are ripe three weeks or a month before those in British Columbia.

Before training commences the most forward bines are pulled out by some growers, but this practice is not general. In the ordinary way the first bines are put up. It is perhaps worthy of notice that the hills often shoot very irregularly in the Pacific Coast hop-yards, this being due in some measure to root-tumour, a disease which kills the plants, and also probably to carelessness in replanting and training. In some experiments * conducted at Sacramento, Mr. James Thompson has shown that in one acre which was subjected to very careful observation, no less than 56 hills were missing out of a possible 967 on one representative acre in a yard of 600 acres, and on the same acre there were 42 other hills so weak that they produced no hops. Thus 10 per cent. of the total number of hills were for all practical purposes absent, since in the method of stringing adopted there is no possibility of filling up the gaps by cross-stringing from neighbouring hills.

On the high trellis it is usual to train two bines to each string. Three trainings are usually given to each hop-yard, and after the strings are furnished the superfluous shoots are cut off with a knife, a method which is much more expeditious than pulling, and which gives satisfactory results. Stripping may or may not be carried out: it has not the same importance as in England, since the hop aphis, being less troublesome, does not breed excessively on the lower leaves. Sheep are usually employed for the purpose of stripping.

The low trellis requires far more careful training than the high, since the bines do not twine readily round the angular poles. Four bines are usually trained to each pole and tied in position by the use of threads unwoven from old "gunny" sacks. As soon as these bines have reached the top of the pole they require to be trained down on to the horizontal strings; and this operation must be carefully performed, for if the bines are allowed to become twisted up above the pole, it is well-nigh impossible to unravel them without damaging them. The cost of training on the low trellis amounts to from $13–15 (54*s.* to 62*s.* 6*d.*) per acre, whilst that on the high trellis can be done for from $8–10 (33*s.* to 41*s.* 6*d.*) per acre.

Manuring.—At present the application of manure plays a very small part in the work of the Pacific Coast hop-farmer, and, in view of the large crops which are annually produced on some of the hop-yards without manure, it would almost seem that manuring is unnecessary. Instances are not wanting, however, of a steady decline in yield in some of the older yards, and some few of the growers in the Oregon districts are commencing to manure with waste products, such as meat and bone manures. Other growers have used horse manure with success. On the other hand I met no grower who had reaped any advantage from the use of potash, phosphates, or the readily available nitrogenous manures, though several growers had made small trials with these fertilisers.

---

* U.S. Dept. of Agric., Bureau of Plant Industry, Circular No. 56: "Some Conditions Influencing the Yield of Hops."

In the applications of such manures to these hop-yard soils there is one peculiar condition to be kept in mind. The top 3 or 4 in. of soil is maintained as a dust-dry mulch, in which the roots cannot grow. If, therefore, the fertiliser were put on after the first ploughing, it is quite possible that no benefit would accrue to the crop until the second year after application, since the fertiliser would be mixed with the dry mulch through the first summer, and probably would not reach the feeding roots of the hops in the moister depths of the soil until the following winter rains set in.

Diseases.—The Hop Aphis is prevalent in all the hop-yards on the Pacific Coast, but never causes a tithe of the damage that it does in England or on the Continent. The aphides make their appearance gradually on the foliage of the hops, and never in the swarms so common to the English hop-gardens in May and June, but scattered winged aphides appear, which gradually give rise to the green lice. The lice multiply slowly as the bine grows, but in this hot dry climate the foliage is less succulent, and consequently the aphides, having greater difficulty in obtaining the plant sap for their food, reproduce but slowly. In some seasons it may happen that a hot dry north wind will prevail for two or three consecutive days, parching the vegetation and checking the growth of the hop bines, but making some compensation by exterminating the hop aphides, which perish in the scorching atmosphere. The disappearance of the hop aphis from the English gardens in July, 1911, was doubtless in many respects comparable to the more frequently occurring phenomenon in California. In the event of no such hot wind the aphides continue to increase, but never to such an extent that the bine "goes black," as in England. Finally the aphides collect in the hop cones, and, if picking is delayed too long, the aphides die, and a black fungus grows upon their bodies, producing the condition known as "black mould." This latter change, however, takes place much more slowly in the dry climate than in a moist one.

The winter stage in the life-history of the hop aphis in California remains in some doubt. Opinion is divided as to whether the aphides pass the winter on some sort of prune, from which the winged aphides migrate back to the hops in spring, or whether the aphides do not migrate at all, but pass the winter on the rootstock and among the roots of the hop itself. (In England, while the winter is passed chiefly in the egg stage on damson, sloe, bullace, and it may be on plum, a few of the aphides hibernate in the hop hills.)

According to Clarke * the first aphides to appear in the hop-yards of California are not winged, but wingless, aphides, which simply crawl up the bines of the male hills only. These give birth to lice which grow to be wingless females; there are also occasional winged individuals, which fly to the neighbouring female hop bines, and so spread the pest. In autumn, after the hops are picked, the foliage of the male hop plants continues green for some little time after that of the female plants has yellowed off. Upon this foliage of the male plant Clarke has observed occasional oviparous females, and also a number of winged male aphides. At the time when his paper was published no aphides had been observed on the roots in winter, but it was assumed that these oviparous females deposited their eggs on the rootstock of the hops, or in close proximity to it. In the course of correspondence with Professor Clarke I learn that since the publication of the paper these aphides have been observed in large numbers in the mass of roots just below the crown of the hill in the spring of the year.

At present, so far as I am able to learn, these observations have not been confirmed. On the other hand, the sloe, damson, and bullace, the normal winter hosts of the hop aphis, are not prevalent in California. It is possible that the hop aphis may winter upon some of the prunes in that country, but seeing that it rarely winters on any prune in England

---

* *The Hop Aphis*, Warren T. Clarke, Univ. of California, Bull. No. 160.

except the wild sloe, the damson, and the bullace, this latter suggestion needs definite observation before acceptance.

The material used for *washing* consists of quassia extract or tobacco extract, together with soft soap dissolved in water. The methods of application are not so advanced as those in England. In general the hop-washing outfit consists of a barrel of wash mounted on wheels and drawn from place to place by horses. In the barrel is fixed a hand-pump, from which the wash is delivered through 50 ft. lengths of rubber hose to two hand nozzles. In a recent modification of this outfit the pump is driven by a small 2 or 3 h.p. gasoline engine, which supplies four nozzles. This form of apparatus, though exceptionally good for fruit spraying, is not very efficient for hop-washing.

Upon one of the E. C. Horst Co.'s ranches in British Columbia I saw a very useful method for supplying the power for spraying on a large scale. In this the power was furnished by compressed air. At the homestead, where the oasts were situated, was an engine used at hop-drying for driving a paddle-wheel fan. This engine was employed to drive machinery for filling cylinders with compressed air. The cylinders of compressed air were then carted to the hop-yards, attached to specially constructed hop-washing tanks and used to produce the force necessary for spraying. It is conceivable, that some modification of this principle might with advantage be applied in some of the large hop-growing businesses in England.

Two *Flea Beetles, Plectroscelis concinna and Psylliodes attenuata,* are harmful in the English hop-gardens. The Flea Beetle *Psylliodes punctulata* has been the cause of very serious loss to hop-growers in British Columbia during recent years.* Its appearance was first recorded in 1903 in the neighbourhood of Agassiz, B.C. It rapidly increased in numbers and extent until in 1908 it was estimated that the British Columbian crop was reduced to the extent of 75 per cent. by this pest. In consequence of this a large proportion of the hops in British Columbia have been grubbed, and those that remain are in the hands of very few growers.

---

* *Some Insects Injurious to Truck Crops,* W. B. Parker, U.S. Dept. of Agric., Bur. of Entom., Bull. No. 82.

Owing chiefly to the work of Mr. W. B. Parker, the life-history of this insect has been completely worked out, and methods of controlling its depredations have been devised. This Hop Flea Beetle, which is a native American species, had been observed upon other plants in the district previous to the outbreak of the epidemic, while the first damage was noticed on hops introduced from England, and local prejudice attributes the outbreak to the importation of the flea beetle with the sets. The beetle is a general feeder, turnip, radish, cabbage, mustard and beet being among its food plants.

It has been shown that the beetle passes the winter in the adult form, the adults hibernating in protected places, such as splinters in the poles, hollow stems of the hop bines, and so forth. In the warm days in spring it comes out of winter quarters and soon lays its eggs to a depth of about 2 in. in the soil. The eggs hatch in a fortnight, or over, and the larvæ feed on the delicate rootlets of the plant. The adult beetles feed on shoot, bud and leaf; holes are bitten in the leaves, and if the beetles occur in numbers the whole plant may be devoured. The hop cones are also infested. Spraying operations have not been very successful as a remedy.

Successful methods of dealing with the pest have been along the following lines:—

(i.) Limiting the number of places where hibernation is possible by removing and burning the string, pegs, and also the hollow stems which are left attached to the hill in winter and cut off in spring. With the same purpose any splinters on the split poles are burnt off with a flame in spring.

(ii.) Catching the adult beetles upon tarred frames as soon as they come out of winter quarters and begin to feed on the young hop shoots in spring. This is done by sweeping them off the shoots with a feather brush, so that they jump on to a tarred frame, upon which they stick.

(iii.) As soon as the bines are tied to the strings both the bines and the strings and poles are greased with a band of grease 2 or 3 in. in width. The beetles crawl upon the grease, and are caught as they ascend the bines, just in the same way as the winter moth is trapped on fruit trees in England.

By these methods the damage done by the flea beetle can be controlled in British Columbia, so that a full crop of hops can again be produced. Up to the present this pest has not made itself evident in Washington, Oregon, or California, but should it do so, it is likely to raise the cost of production considerably.

The Red Spider is more prevalent on the Pacific Coast than in England. It causes considerable damage at times to the hops, especially in the hot Sacramento Valley of California. At present no effectual means of controlling it are known.

The Hop Mould disease is unknown upon the Pacific Coast. I learn, however, that it is present in the hop-yards of New York State, and that in 1910, for the first time, it caused damage to the crop in one garden.

Root Tumour is the name given to one or more diseases to which hop plants on the Pacific Coast are subject. Little is known about these diseases, though considerable damage is caused by them. The diseases are known by a variety of names, of which Root Tumour, Canker, Sour Sap, are a few of the more common. Some of the appearances are as follows:—In spring, when the hills are opened for cutting, it is found that the straps and rootstock are covered with large swellings, which, when cut off, leave a very small and weak stock. It is also noticed that in affected gardens the hills commence to grow very unevenly; the sound hills may have a bush of 20 or 30 shoots, whilst the diseased hills are very weak or have not started to grow.

THE THATCHING OF RICKS.

A. BRADSHAW.

METHODS of thatching vary in different districts, owing partly to the positions in which rick yards are situated. Some ricks are exposed to heavy storms of wind and rain, and require more thatching material than those in less exposed situations. The method described here is that which is practised in West Worcestershire.

Any agricultural labourer with a little energy and confidence can learn the business of thatching from a good thatcher, and for this purpose young men should be allowed to work with good thatchers as assistants or "Thatcher's Boys." The thatcher will be able to do more work in a given time by having help; time and money will thus be saved, and a young thatcher will be trained.

Outfit and Materials.—The outfit required is small, consisting of some stout pieces of bagging or carpet for knee-caps, a small hand-rake with short wooden teeth (half a hand-rake with the thin end for a handle, the teeth shortened to about two and a half inches long and pointed), and a pair of sheep shears. Wheat and rye straw are the materials generally used for thatching.

Preparation of the Straw.—If wheat straw is chosen it is best to draw it before using, as follows:—A bolten or truss is laid on the barn floor with the ear-end of the straw towards the operator's left hand; the bands are cut and taken care of; the best of the straw is picked out, the rubbish and short straw being brushed out by either hand of the operator as he gathers the straw between his hands and legs. As soon as he has a fair quantity he lays it aside and repeats the operation as long as the bolten lasts. The drawn straw is then tied up with one of the strings from the truss.

The bundles so formed are then wetted, either from a pail or in a pool or stream. Wetting from a pail will take longer, but is not so liable to make the straw untidy and dirty. The straw is used while it is soft.

Preparation of Pegs.—Pegs can be made out of any straight wood that can be got cheaply, and should be of the thickness of one's fingers; thicker sticks ought to be split. For hay ricks it is not necessary to have pegs longer than from, say, fifteen to thirty inches, but for straw or corn ricks pegs from two to three feet in length are better.

The thick end of the stick should be sharpened to a point, and the top end cut off at a right angle to avoid injury to the thatcher's hand. Further, the top of the thicker pegs ought to be flattened for two or three inches from the end to avoid making a large hole in the thatch. The spurs need not be trimmed off closely, as they will help to hold the peg in the roof.

Actual Thatching Operations.—In a great many cases it will be necessary to put a bolster along the ridge to hold the thatch up to a point. The bolster is made by tying the loose stuff which was discarded from the straw with string or straw bands in sections six to eight feet long, as required.

The usual place to start thatching an oblong hay rick is the end, because fewer traces of finishing off are shown. Before any straw is laid on the rick, the width to be covered must be prepared by levelling down lumps, filling in holes and removing loose stuff which would provide a lodgment for rain. While thatching the ends of the roof it is best to fetch the straw from the ground in small armfuls as required. The laying of the straw is the most important part, and the best way to do it is to take a handful, tuck the ear-end (which has been rolled into a ball) into the rick, at such a height that the bottom ends of the straw just reach the eaves. Each handful is put on in the same way, until the width to be covered is complete.

The second laying is done in the same way, but the bottom ends of the straw are laid just as near the eaves as necessary to be held down by the bottom string, say about nine inches from the cut eaves. The third and subsequent layings are simply laid on the roof, but with the *ear-end down,* each laying overlapping the lower one by about half the length of the straw. The quantity of straw will depend on the state of the roof; if the roof is steep, a less quantity will suffice than on a flatter roof.

When thatching an oblong roof at the ends and corners the straw must be laid as on a round roof, viz.:—Each move of the ladder ought to make a triangle with the apex at the end of the ridge, and all the straw must lie pointing towards the end of the ridge. It may not always be possible or safe to rest the ladder so that the top of it is at the end of the ridge, but the straw must be laid as stated above.

The best way to obtain the straw from the boltens is to take sections of the boltens as they fall naturally from the bulk when moved gently, and adjust as many as are required for a double handful, so that the whole is little longer than the individual straws, then lay it on the roof and distribute it to the required thickness by shaking it gently, and longitudinally, at the same time moving it crosswise as required.

Position of Strings and Pegs.—As the side of the roof will be longer than the ends, more strings will be required. They must be introduced as progress is made down the corner. The number of strings necessary at the end will be decided by the depth of the roof; they should, however, be a little closer together than they will be on the sides, where the top one ought to be as close to the ridge as possible, the second one about a foot or fifteen inches below the first, the third twenty to twenty-four inches below the second, and so on in increasing proportions; the bottom one being about nine inches from the cut eaves (see diagram). More strings are required on ricks in open situations, or where the wind may be troublesome, than on ricks in sheltered situations. As soon as the corner is complete, or perhaps a little before, it will be possible to take a whole bolten up and lay it on the roof to the left of the operator, with the ear-ends downhill. Now the work is straightforward. The width to be covered

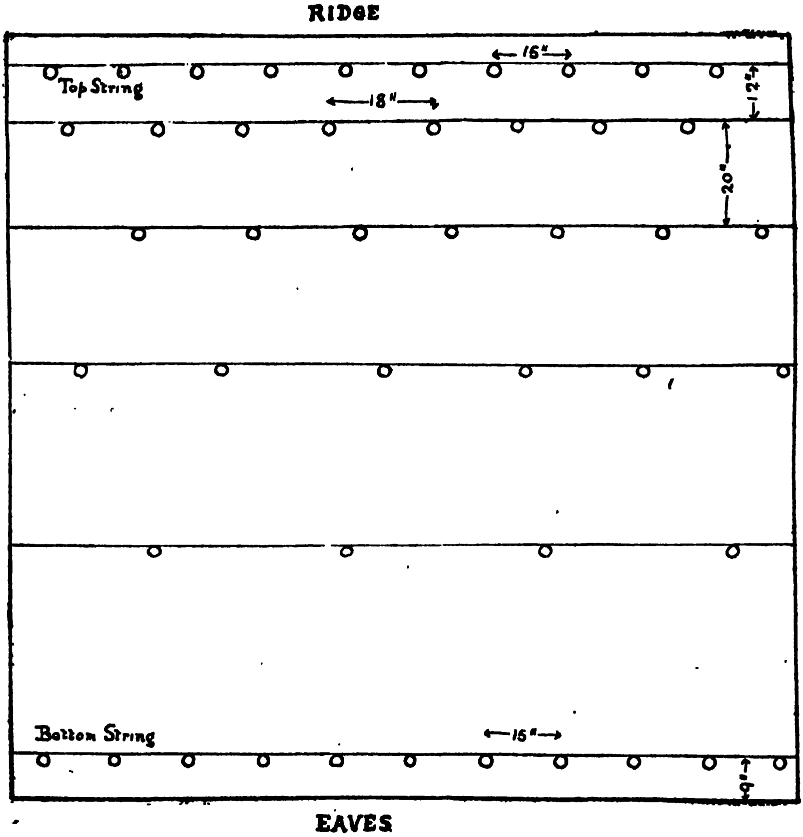


DIAGRAM OF SECTION OF ROOF SHOWING POSITION OF STRINGS AND PEGS.

is called a stelch, and is the same at the top as at the bottom. A quick hand can work along the roof in a short time if he has a handy assistant. It is the ends which take up so much time.

As each stelch is laid the straw is gently raked from the ridge to about the second string down, then the first string is brought along to near the ladder. A good way to fasten the string on the pegs nearest to the ladder is by means of the builder's knot. It is simple and takes up little string. The string is passed round the peg, but with the loose end *under* the fast end; it is then passed round the peg again above the first tie, and the loose end again put under the fast one. It is easiest done by making each loop before putting on the peg, pulling the string tight between the two loops. It is not necessary to fasten the string on the intermediate pegs more than once round. The pegs of the first string are put about fifteen inches apart. The peg of the ball of twine is then put gently into the thatch near the last peg. More straw is raked and number two string brought along, but fewer pegs are required in this and all the other intermediate strings. Eighteen inches is a sufficient distance between the pegs in the second string, and the distance will be greater for each succeeding string down the roof. The bottom string requires to be firmly pegged with long pegs about fifteen inches apart. All pegs must be put in as nearly horizontal as possible, and a peg should not be put immediately under one in the string above it, or a kind of gutter will be formed, and the wet will probably get in. For variety one or more of the middle strings may be crossed or zig-zagged.

The eaves must be cut, and the proper way is to hold the shears horizontally and cut towards the rick. There will not be much to cut off if the straw was laid properly, and the eaves will appear thin and neat. This is repeated until the side of the roof is finished. The second corner must be done in the same way as the first one. Some of the middle strings will have to be cut off as they join the bottom string which comes up the eaves of the corner. In windy situations it is advisable to put a short string across the bottom of each corner.

As soon as the third corner has been rounded, and all the strings are in position, the ridge will have to be trimmed. The way to make the neatest ridge is to hold the shears vertically, and cut the straw downwards. If a straight, level ridge, which adds considerably to the appearance of the finished work, is wanted, it must be made now. It is best to fasten the two top strings before the ridge is trimmed. Care must be taken to collect the trimmings or they will make the thatch look rough. The ridge can easily be levelled by pulling the straw up or knocking it down gently.

Progress of Afforestation on Inverliever Estate, Argyllshire.[*]

The Board have been furnished by the Commissioners of H.M. Woods and Forests with the following account of the progress of the work on the Inverliever Estate during 1911:—

Existing Woods.—Neither labour nor time were available for attention to the existing woods, and only a little thinning was done to provide fencing material for Crown tenants. The gale in November, 1911, did considerable damage in the plantations, and a large number of trees were blown down; in April another gale uprooted several trees. In the plantations near New York the fallen trees have been trimmed.

New Plantations.—The planted areas were cleared where necessary, and failures were replaced in compartments 1, 2, and part of 3. In compartment 1, 6,000 larch, in compartment 2, 35,800 larch, 3,100 silver fir, and 1,400 spruce (on mounds), and in compartment 3, 10,000 larch, 1,200 silver fir, 10,000 common spruce, 2,300 Sitka spruce, and 1,500 Douglas fir were planted out.

The young trees on the slopes in compartment 1 have now fairly started, and will probably require very little attention next year.

New Work, 1911–12.—The altitude of the site planted this season, with the exception of about 30 acres, varies from 800 ft. to over 900 ft. above sea-level.

As a considerable part of it was very swampy, a great deal of draining has been necessary, and nearly 2,270 chains of drains have been dug.

---

[*] Previous reports on the progress of afforestation on Inverliever Estate have appeared in this *Journal,* vol. xv. p. 620; vol. xvi. pp. 219, 980; vol. xvii. p. 308.; and vol. xviii. p. 321.

Sites for future roads have been selected and have been left unplanted.

About 97 acres in compartment 3, and 90 acres in compartment 4, have been planted this season. Of these, about 1 acre in 3, and 10 acres in 4, have been planted in inverted sods. With the exception of about 4 acres (compartment 4) pit-planted, the planting has been done with the semi-circular planting spade. On the sods about 2,050 plants and in the remainder about 2,750 plants per acre have been put out.

In all, 509,600 plants were used, of which 297,600 were taken from the nursery at Ford, and 212,000 were purchased. The numbers of the different species were as follows:—Spruce, 321,600; Sitka spruce, 30,000; larch, 69,000; Scots pine, 71,500; silver fir, 9,000; and Douglas fir, 8,500.

The season has been most unfavourable for planting; the autumn was unusually wet, and the frosts in January and February were severe. These causes not only delayed work, but added to the expense.

Damage by Game, &c.—Although a trapper was regularly employed to keep down rabbits, a number found their way into the enclosure from outside during the stormy weather in January, and destroyed about 25,000 larch newly planted, necessitating replanting. It is hoped to prevent a recurrence of this by killing these pests on the land in advance of the planting.

Black game were even more numerous than last year, and have inflicted serious damage to the larch and Scots pine; they were still eating the buds at the end of May. Men were employed going through the young plantations to keep the birds on the move, and feeding them with grain on a moor a little distance away was also tried. Both efforts were unsuccessful.

Nursery.—It was found impossible to secure horses, and difficulty was experienced in procuring manual labour; consequently the new part of the nursery could neither be cultivated nor be thoroughly cleaned. The scarcity of labour also delayed other work, and seedlings, which should have been transplanted, have remained in the seed-beds. 370,480 seedlings were lined out.

Two hundred and forty yards of seed-beds, 4 ft. wide, were sown with beech, larch, spruce, Sitka spruce, Douglas fir, and Scots, Corsican, and mountain pines.

Both plants and seeds, with the exception of some Sitka spruce and larch, did exceedingly well during the year. The drought in June was the cause of the poor growth of the larch.

General.—A new house is in course of erection for the nurseryman and handyman. The house occupied by the former is being converted into a bothy, and it is hoped with this additional accommodation sufficient labour will be procurable next year to prevent delay in the nursery work.

Wheat Offals.

Various terms are employed in different parts of the country to denote wheat offals from the process of milling, and the following account of the use of these terms, kindly supplied to the Board by Mr. T. G. Dobbs, Secretary of the National Corn Seed and Manure Trades' Association, may be of interest.

The terms pollards, toppings, sharps, thirds, fourths, and middlings all refer to similar mill offals. "Toppings" is used principally in the Eastern Counties, and seems to correspond to what is known as "sharps" in the Midlands and "middlings" in some other districts.

The term "toppings" is also used in some districts in Ireland, but usually denotes oatmeal toppings, representing oat shudes with some of the meal with them.

In Liverpool "seconds" correspond to what are known as "fine middlings" in London and the south of England, and "thirds" to "coarse middlings," while "sharps" in Liverpool are known as "pollards" in London. In Glasgow the terms "toppings" and "middlings" are not used, but are apparently replaced by "common thirds" and "fine thirds" respectively.

There is apparently no uniform standard as to the fineness or coarseness of these offals, each individual miller having a standard of his own.

Necessity for Precaution in Storing Calcium Cyanamide on Farms.

The Board of Agriculture and Fisheries desire to draw the attention of agriculturists to the need for precaution in storing calcium cyanamide on farms. Calcium cyanamide contains calcium carbide in varying proportions, and the latter gives rise to an explosive gas, acetylene. Experiments carried out by the Board of Trade showed that, in the case of the particular samples investigated, one ton of calcium cyanamide in dry air rendered 3·6 cub. ft., or in moist air 6·1 cub. ft., of air explosive in twenty-four hours. From this it appears that there is some possibility of danger in storing the calcium cyanamide in damp, unventilated sheds, cellars, &c., and dry, well-ventilated conditions should prevail in places selected for the storage of this manure. If the material is actually wetted when in store it becomes a source of considerable danger. Further, it is most important that the cyanamide should be kept dry in view of the fact that moisture may induce chemical changes which would probably cause the material to deteriorate in value as a manure.

Poultry in Great Britain.

In connection with the inquiry carried out by the Board under the Census and Production Act, 1906, opportunity was taken to obtain information as to the poultry industry of Great Britain, and occupiers of farms were asked to state the number of fowls, ducks, geese, and turkeys respectively on the farm on June 4th, 1908, distinguishing those hatched in 1908 from those hatched previously. They were also asked to state the number of home-bred poultry of each description sold during the preceding twelve months. Special schedules were issued to all occupiers returning not less than 50 fowls or 10 ducks, geese, or turkeys, asking for the number of males and females respectively hatched before 1908, the number of eggs produced, sold for consumption, or sold or used for hatching, and the number of young and adult birds sold.

The returns are summarised below, but it must be stated that these only relate to holdings exceeding one acre in area.

Poultry are, of course, very largely kept by cottagers and persons who do not come within the definition of occupiers of agricultural holdings, while a further very large poultry population would no doubt be enumerated if the returns were extended to the towns.

The numbers on the farms of Great Britain on June 4th, 1908, were calculated as follows:—

Fowls	32,356,000
Ducks	2,963,000
Geese	712,000
Turkeys	697,000

The total extent of cultivated land in Great Britain—*i.e.*, of the land included in these returns—is 32,211,000 acres, so that the number of fowls kept is on an average almost precisely one per acre. For every 100 acres there are also kept 9 ducks, 2 geese, and 2 turkeys. The density of poultry differs greatly in different districts and on different classes of holdings. Grass farms have the greatest average density on the whole, though on farms of this class exceeding 300 acres the stock is very small. The pre-eminence of small farms—*i.e.*, of 50 acres and less—as regards the number of poultry of all kinds to the acre is very marked, by far the greater density being found on those not exceeding five acres. Fowls are kept in larger numbers in England than in either Wales or Scotland, but Wales has the largest stock of geese in relation to acreage. The division of England in which fowls appear to be kept in the greatest number is the north-western group of counties comprising Cumberland, Westmorland, Lancashire, Cheshire, Derby, and Stafford. The influence of small holdings in Lancashire and Cheshire and the close proximity to great markets may account for this.

In ascertaining the total number of poultry kept it was thought desirable to distinguish between those hatched before the year of the return and those hatched in that year. As the returns were made on June 4th, the number hatched in 1908 would, of course, include only those hatched in the first five months of the year, and would therefore not completely represent a whole year's "output," though returns for the later months of the year would probably not raise the total very considerably. The numbers kept and the number of eggs produced, as calculated from the returns, are as follows:—

—	Hatched.		Total kept.	Eggs produced.
	Before 1908.	In 1908.		
Fowls	17,443,000	14,913,000	32,356,000	1,108,483,000
Ducks	1,029,000	1,934,000	2,963,000	27,260,000
Geese	253,000	459,000	712,000	1,724,000
Turkeys	199,000	498,000	697,000	1,826,000

The numbers of poultry on the farms on June 4th being based on the annual returns made by each occupier may be regarded as fairly complete, but the figures of egg production, calculated from a more limited number of returns, may be subject to a wider margin of error. The returns from which they are calculated were obtained from occupiers having 50 or more fowls or 10 or more ducks, geese, or turkeys. Many of the smaller poultry-keepers would consequently be excluded, while, generally speaking, all the larger farms would be included. There has been in recent years a steady diffusion of interest in poultry among farmers, and on many medium-sized and even large farms serious attention is now given to this long-neglected branch of agricultural production. But it is undeniable that on a very large number of holdings fowls are still kept in a casual manner, and the effective egg production per hen per annum is often very small. The annual production of eggs works out at an average for the 15½ million hens on farms in Great Britain at 72 per hen. The total egg production from farm poultry may appear somewhat disappointing in proportion to the total stock, and it must further be remembered that the supply which comes into the market is very much less. The consumption of eggs and poultry in over 500,000 households supplying their home demands at "cost price," and therefore on a relatively lavish scale, makes a very large initial inroad into the total supply. It may indeed be said that to a considerable extent the output of eggs and poultry—*i.e.*, the quantities sold off the farms—represents the surplus remaining after the producer's own requirements have been satisfied. The total value of the output of eggs and poultry from the agricultural holdings of

Great Britain is calculated from these returns at about £5,000,000. This sum, it must be repeated, takes no account of poultry kept by cottagers, residents in towns, and others not within the scope of the agricultural returns. The aggregate production thus excluded must be very large, though, again, it may be assumed that the greater part of it is consumed by the poultry-keepers themselves.

Agricultural Co-operation in Germany.

THE following information, taken from the *Jahrbuch des Reichverbandes der deutschen landwirtschaftlichen Genossenschaften* for 1910, may be given in continuation of the note which appeared in this *Journal* for November, 1911, p. 692.

Agricultural co-operation in Germany has found expression mainly in the direction of the formation of agricultural credit associations, these numbering 15,517 on June 1st, 1910, out of a total of 23,845 agricultural societies. Owing chiefly to the large area of Prussia and Bavaria compared with other states, the co-operative societies in these two states alone are equal to about three-fourths of the total number of such associations in Germany.

	Prussia.	Bavaria.	Other States.	Total.
Credit Societies	8,225	3,315	3,977	15,517
Trading „	1,122	194	964	2,280
Dairy „	1,964	479	890	3,333
Other „	1,730	499	486	2,715
Total	13,041	4,487	6,317	23,845

In 1910 there was one agricultural society for every 2,543 inhabitants of Germany, as compared with one for every 2,890 inhabitants in 1907. Another indication of the importance of the agricultural co-operative movement is afforded by the area of agricultural land in Germany per agricultural society. This will be seen from the following table, which gives in addition the relation of the movement to the population :—

	Population per Agricultural Society in 1910.	Agricultural Land per Agricultural Society in 1910.
	No.	Acres.
Prussia	2,859	4,359
Bavaria	1,454	2,546
Germany	2,543	3,631

Although in the case of the majority of these agricultural associations the liability of the members is unlimited, the principle of limited liability is gradually being adopted in societies other than credit associations. Taking the societies as a whole, the liability of only 11 per cent. was limited in 1897, but this proportion increased to 21⅓ per cent. by 1910. The figures for 1910 for the different societies are of interest.

	Unlimited Liability.		Limited Liability.	
	No.	per cent.	No.	per cent.
Credit Societies	14,325	92·32	1,172	7·55
Trading „	1,258	55·18	1,019	44·69
Dairy „	2,202	66·07	1,062	31·86
Other „	867	31·93	1,832	67·48
Total...	18,652	78·22	5,085	21·33

As regards the number of central societies, there were in 1910 41 credit societies, 31 trading societies, 8 dairy societies, and 14 other societies, so that there is, roughly, one central society for 378 credit societies, 72 trading societies, and 416 dairy societies.

Credit Societies.—Reports were received in 1909 from 12,614 credit societies belonging to unions affiliated to the Imperial Union, with a membership of 1,163,186, showing assets amounting to £97,127,000 and liabilities amounting to £96,776,000. The total loans to members in 1909 were £14,379,000 for fixed periods and £30,682,000 on current account. The reserve funds of all the credit societies together equalled £2,549,000. The costs of administration in 1909 were £387,884, *i.e.*, at the rate of £31 per annum per society. Some idea of the large amount of work done by these societies may be gathered from the fact that the total transactions (receipts and expenditure) in 1909 amounted to £222,808,000.

Agricultural Trading Societies.—There were, in 1909, 32 unions of agricultural trading societies affiliated to the Imperial Union, these unions comprising 2,081 reporting societies with 230,707 members. The total transactions of the societies in 1909 were £5,545,000, these including purchase of 580,000 tons of manures, 302,000 tons of feeding stuffs, and 11,000 tons of seed. The costs of administration in 1909 amounted to £151,778, or at the rate of £73 per annum per society.

Dairy Societies.—In 1909, 1,946 reporting societies with 200,385 members were grouped into 36 unions belonging to the Imperial Union. The amount of milk received from members was 2,230,000 tons, of which 151,000 tons were sold as milk, and 84,000 tons as butter. The sales of dairy produce of all kinds amounted to £10,194,000 and £9,113,000 was paid to members for their milk, in addition to the return of skim milk. The costs of administration of the societies amounted to £972,493, or about £500 per society per annum.

Other Societies.—The following particulars relate to societies other than the above, which in 1909 were comprised in the Imperial Union of Agricultural Societies.

There were, in 1909, 49 societies for the sale of corn, with 12,613 members, 12 milling societies with 1,048 members, 147 distilling societies with 3,218 members, 18 starch factories with 1,056 members, 52 fruit or fruit and vegetable societies with 5,345 members, 21 societies for the sale of potatoes with 1,308 members, 79 societies for the sale of eggs with 9,484 members, 119 societies for the sale of vineyard produce with 5,962 members, 49 animal breeding societies with 3,565 members, 84 societies for marketing animals with 22,612 members, 18 societies with 1,159 members for marketing poultry, 5 insurance of live-stock societies, 92 societies for the supply of electricity, and 249 societies for the co-operative ownership of agricultural machinery.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

FIELD CROPS.

Potatoes: Varieties and Change of Seed (*Essex Educ. Comm., Co. Laboratories, Chelmsford, Rept. on Field Experiments,* 1911).—A number of varieties of potatoes were tested at the Central Experiment Station. Of the earlier varieties, Eclipse gave the greatest total yield, though Epicure produced the greatest weight of "ware." Sharpe's Express gave the lowest weight of crop, but was considerably the earliest variety. Of the late varieties Up-to-Date gave the largest yield of ware, though in total crop Northern Star was easily first. "Seed" obtained from Saffron Walden gave almost as good results when grown at Chelmsford as Scotch "seed," and both proved considerably superior to that obtained locally.

---

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Varieties of Wheat for Spring Sowing (*Essex Educ. Comm., Co. Laboratories, Chelmsford, Rept. on Field Experiments,* 1911).—Trials were conducted at two centres to compare six varieties of spring wheat; to add to the interest and value a well-known autumn variety, Squarehead's Master, was sown alongside at the same time (February 23rd). The spring varieties were Dreadnought, Sensation, Svalöf Pearl, Burgoyne's Fife, and at one centre Red Marvel, at the other the similar variety, Red Admiral. The results obtained at the two centres agreed fairly well; at both, Dreadnought gave a heavy yield of grain, though in the one case, where it was tried, Red Admiral proved slightly better. Squarehead's Master produced a crop only slightly inferior to that of the best three varieties—Red Admiral, Dreadnought, and Red Marvel. Burgoyne's Fife gave a heavy crop at one centre, but at the other it was not so satisfactory. Svalöf Pearl in habit of growth and appearance of straw closely resembled Burgoyne's Fife, though the grain was red and similar to that of Red Fife. A local buyer valued the samples, and estimated the Svalöf Pearl to be worth 37*s.* a quarter, Burgoyne's Fife and Squarehead's Master, 36*s.*, and the rest 35*s.* 6*d.* Mr. Humphries, the Chairman of the Home-grown Wheat Committee of the National Millers' Association, valued the Burgoyne's Fife at 40*s.*, as against 35*s.* 6*d.* for the Squarehead's Master and Sensation. It is pointed out that if four or five shillings a quarter more could be obtained for strong varieties, such as Burgoyne's Fife and Svalöf Pearl, farmers might profitably grow them.

Red Marvel sown in March and April did not give such good results as that sown in February.

Varieties of Barley and Oats (*Essex Educ. Comm., Co. Laboratories, Chelmsford, Rept. on Field Expts.,* 1911).—Five varieties each of barley and oats were compared at three centres in 1911. In addition to yields of grain, attention was paid to strength of straw, earliness, and quality of grain.

Of the barleys, Plumage, a variety closely resembling Goldthorpe, gave on the whole the best returns when both yield and quality were taken into account. Taking the average of the two centres where it was grown, Archer gave the heaviest weight of grain, but it was estimated to be worth less per quarter than any of the other varieties. Of all the varieties, Maltster had the strongest straw, and stood perfectly erect until harvest, even at a centre where all the other varieties suffered more or less from "lodging." Plumage and Primus (a Svalöf variety) proved to be stronger in the straw than Archer, Chevalier, and Medium Wide. Primus, the seed of which was obtained direct from Sweden, ripened off quite ten days ahead of the earliest of the other varieties.

Of the oats, Svalöf Victory gave the heaviest yield of grain, followed by Beseler and Abundance. Abundance, however, produced the finest sample with the thinnest husk. Yielder and Record, and, to a less degree, Beseler, appeared to be admirably adapted for land where lodging might be feared, though the two former varieties gave comparatively poor yields of grain, which was, like that of Beseler and Victory, thick in the husk.

Growth of Sugar Beet (*Wilts C.C. Agric. Educ. Comm., Results of Field Manurial Demonstrations,* 1910–11).—Sugar beet was grown at five centres in Wiltshire in 1911, under different systems of manuring. Owing to the dry season the full effect of the manures was not produced, but it is interesting to note that the weight of crop obtained varied from 7 tons 16 cwt. to 18 tons 1 cwt. per acre. Samples of the roots grown on the different plots at four of the centres were analysed. The average percentage of sugar in the roots was 15·7.

Growth of Sugar Beet (*Devon Co. Agric. Comm., Report on Field Expts.,* 1910–11).—At seven centres in Devonshire in 1911 three varieties of sugar beet were grown. The average weight of crop per acre was just over 14½ tons, the results at the different centres varying from 9 tons 2 cwt. to 19 tons 14 cwt. The average content of sugar in the roots was 16·96 per cent., the variation being from 15·30 per cent. to 17·40 per cent. At three centres where the two crops were compared, the weight of sugar beet was about half that of mangolds grown under similar conditions.

The Causes of the High Nutritive Value and Fertility of the Fattening Pastures of Romney and other Marshes in the S.E. of England (*Journ. of Agric. Sci., June,* 1912; *Mr. A. D. Hall and Dr. E. J. Russell, Rothamsted Expt. Sta.*).—The marshes of the Kent and Sussex coast are of considerable area, the largest being Romney Marsh, which forms a single area of about 20 miles by 10 miles. Though called a marsh, the surface is generally dry, and the water-level in the ditches, by which the land is traversed, is generally three or four feet below the surface. As a rule, the land lies in permanent grass, and gives some of the best grazing known in the south of England, but while the grass land is generally rich it is by no means equally fertile everywhere. In most districts fields of great local reputation occur, many capable of fattening six or eight sheep per acre without extra food, but adjoining these fields are often found others, apparently of the same character, which will do no more than keep sheep in a growing condition. As ordinary chemical and mechanical analysis of the soils revealed nothing sufficient to account for such great differences, it was decided to carry out a more thorough investigation.

Continuous observations as to soil temperature and water level were therefore made at three stations on Romney Marsh in cases where fattening pastures very closely adjoined poor fields, and detailed chemical and botanical analyses were made, not only of the soil, but also of the herbage. In all three cases both the fattening and the non-fattening pastures were situated on flat, silty land, and appeared to have been formed in the same way.

Taking the results of all three stations together no very distinct factors emerged to account for the differences in the amount and feeding value of the herbage of the two classes of land. At two of the places there was a little difference in the mechanical condition of the soil, but there was no regular difference in the water content. Temperature differences were also small, and though at two of the centres the good field was at a slightly greater elevation than the poor one, and the poor fields generally did not allow rainfall to drain away so readily, it was impossible to attribute the character of the pasture to these differences. The chemical analyses did show, however, certain slight but constant differences; on the whole, there was more total nitrogen in the soil of the good fields, which also contained more phosphoric acid. It may be noted that this superiority was only evident in the total phosphoric acid, and not in the amount of citric acid soluble phosphoric acid, which was always extremely low.

Again, the amounts of nitrates and ammonia in the good soils were always much above the quantities found in the poor soils in the early part of the season. It is suggested that this may account for both the greater amount of growth of herbage on the fattening fields and also its broad leafy character. No explanation, however, was forthcoming as to why the formation of ammonia and nitrates should be more rapid in one class of soils than in the other.

Botanical analysis of the herbage showed very little difference between the floral types of the two classes of soil, and it is suggested that the botanical composition of the herbage is influenced more by climate, situation, and management than by soil. In all cases ryegrass was the most abundant grass, but crested dogstail and *Agrostis* were also characteristic, and golden oat grass and Yorkshire fog were generally present in some quantity, and occasionally occurred abundantly. Comparing the nature of the herbage with the known feeding value of the pasture, it is concluded that the two are largely independent, and that whether any particular species of the grasses considered will be good or poor food depends upon the soil and climatic conditions, and particularly on the management. There was, however, a decided difference in the habit of growth on the two classes of land. On the good land the grasses were essentially leafy, with broad blades and little tendency to run up to flowering heads. On the non-fattening fields the herbage was more markedly stemmy, the leaves fewer, and narrower, and the flower heads came early and abundantly.

Chemical analyses of the herbage from the different soils failed to reveal any difference corresponding to the marked differences in the habit of growth or the feeding value of the plants from the two classes of soil. The general conclusions arrived at may be summarised as follows:—

(1) The feeding value of pasture grass is determined not only by the botanical composition of the herbage, but also by the habit of growth.

(2) The botanical composition of the herbage is determined by temperature, the supply of air and water to the roots, the reaction of the soil and the treatment of the grass, but it is not necessarily affected by variations in the amount of nitrogenous plant food present.

(3) The most important factors governing the habit of growth appear to be the supply of nitrates and ammonia in the soil, *i.e.*, the ease of decomposition of the organic matter. The supply of phosphate is also an important factor.

(4) Even where the same floral type and general soil conditions

persist over two adjoining fields the habit of growth and the feeding value of the grass may be very different.

(5) The ordinary methods of chemical analysis proved quite inadequate in estimating the feeding value of pasture grass.

(6) The soils of the fields possessed no constant properties revealed by ordinary chemical or mechanical analyses. Soil analysis does not give as clear indications with pasture soils as it does with arable soils.

SOILS AND MANURES.

Soil Inoculation for Lucerne (*New Jersey Agric. Expt. Sta., Bull.* 227).—It has long been known that in introducing new leguminous crops, such as lupins, serradella, lucerne, &c., it is extremely advantageous to distribute soil from a field, in which the particular plant has been grown successfully, over the land to be sown with the crop. In America this practice has been very largely employed in recent years for establishing new fields of lucerne. For instance, in a large number of experiments carried out by the New York Experiment Station it was found that when 200 to 300 lb. per acre of old lucerne soil were used with about half a ton of lime, successful results were obtained in four out of every five cases. When the lime was used alone a satisfactory plant was obtained in only two out of every five cases. Apart, however, from the cost of carrying large quantities of soil, there is in some cases a possibility of spreading seeds and spores of weeds and diseases in the soil, and from these points of view pure cultures are preferable to soil as inoculating material. In order to compare the result of inoculation by soil with that by pure culture a series of experiments was carried out. The results obtained in field trials with lucerne are given in the following table:—

Plot.	Treatment.	Total Yield of Dry Matter per acre in First Season.	Weight of Nitrogen per acre in Crop.
		lb.	lb.
1	No Lime. No Inoculation	1,499	25·80
2	No Lime. Inoculated with Soil *	1,458	25·68
3	Lime. Inoculated with Soil * ...	4,526	120·20
4	Lime. No Inoculation...	4,003	104·92
5	No Lime. Pure Culture	1,063	16·66
6	Lime. Pure Culture	3,500	91·08
7	Lime. No Inoculation...	2,194	56·26

* *i.e.* soil in which Lucerne had been grown successfully.

It will be seen that without lime, inoculation either by soil or pure culture produced no effect. Lime alone produced a considerable effect, though not quite so great as suggested by the figures, owing to partial inoculation (particularly of plot 4) from adjacent plots. The pure culture was not so effective as soil.

Manuring of Meadow Hay, Mangolds, Potatoes, and Wheat (*Wilts C.C. Agric. Educ. Comm., Results of Field Manurial Demonstrations,* 1910–11).—At a considerable number of centres a series of plots was laid down to compare the effects of different manures used alone and also in various combinations. The schemes were based on those drawn up by the Agricultural Education Association, and published by the Board, and the quantities of manure used are those suggested in the Board's Memorandum. In addition to the weights of crop, full particulars of the financial results of the manuring are set forth in the report. Owing to the extremely dry character of the summer of 1911 the full effect of the manures could not be realised, and the results were not so pronounced as they doubtless would have been in a more normal season.

Manuring of Mangolds, Swedes, and Potatoes (*Devon Co. Agric. Comm., Report on Field Expts.*, 1910–11).—In this report a detailed account is given of manurial experiments with roots and potatoes carried out in two seasons at several centres in Devonshire. In addition to the weights of crop obtained, a full description is given of the soil at each centre, and in some cases chemical and mechanical analyses were made and are recorded.

The Chemical Composition of Farmyard Manure as a Measure of its Value. Manure Value of Foods (*Trans. Highland and Agric. Soc. of Scotland*, 1912; *Dr. Chas. Crowther and Mr. A. G. Ruston*).—Advantage was taken of the fact that two similar lots of bullocks were being fed at the Experimental Farm of the University of Leeds on different rations to compare in various ways the two lots of manure produced and to see how far the theoretical difference in the "manure value" between the two rations could be actually recovered in crop increases. The feeding experiment was carried out in the two winters, 1908–9 and 1909–10. In each year one lot of bullocks received a daily ration containing a hundredweight or more of roots per head, together with a moderate allowance (4 to 7 lb.) of crushed oats, linseed cake, and decorticated cottonseed meal; the other lot received a daily ration containing 70 lb. of roots per head, along with a liberal allowance (8 to 14 lb.) of oats, cake, and meal. The quantity of straw given as food was the same in the two cases, but the first group naturally required more for litter. In both years the more richly fed bullocks made only slightly greater gains in live weight than the others. The difference in the cost of food was, however, considerable—24*s.* per head in 1908–9, and 38*s.* per head in 1909–10—so that unless a much greater return could be obtained from the dung produced on the high ration it is obvious that the high feeding was comparatively unprofitable.

In both years the manure was allowed to remain undisturbed in the covered yards, where it had been made, until autumn, when it was applied to field crops. Samples of the manure were taken in autumn in both years for analysis, and in the second trial samples were also taken of the fresh manure immediately after the removal of the cattle. The value of the different lots of manure, estimated from their chemical analysis, is given in the table on page 319; nitrogen has been assumed to be worth 12*s.* a unit, phosphoric acid 3*s.*, and potash 4*s.*

As was expected, the manure from Group I. was in both years much more watery than that from the other group, and contained considerably lower proportions of nitrogen, phosphoric acid, and potash, and there obviously must have been considerable loss of manurial matter. This is attributed to loss by drainage

	1908–9.		1909–10.	
	Group I. Heavy Root. Moderate Cake.	Group II. Moderate Root. Heavy Cake.	Group I. Heavy Root. Moderate Cake.	Group II. Moderate Root. Heavy Cake.
Total Manure produced per head (weighed in autumn)	tons. $6\frac{1}{7}$	tons. $5\frac{6}{7}$	tons. $7\frac{3}{8}$	tons. $5\frac{4}{8}$
Value per ton of Fresh Manure calculated from chemical analysis... ...	£ *s.* *d.* —	£ *s.* *d.* —	£ *s.* *d.* 0 8 2	£ *s.* *d.* 0 11 1
Value per ton of Stored Manure calculated from chemical analysis... ...	0 8 0	0 10 10	0 6 11	0 10 10
Calculated "Manure Value" of food consumed per head (Straw used as litter not included)...	1 11 5	1 12 6	1 11 1	1 14 3

in consequence of the large volume of urine voided as a result of heavy root feeding.

Incidentally it may be noted that in the second experiment the manure after storage was found to be moister than when fresh, showing that loss of organic matter by fermentation had gone on more rapidly than loss of water by evaporation.

In the first trial the two lots of manures were applied at the rate of 8 tons an acre, in autumn, 1909, to different plots of grass intended for hay. The hay crop was weighed in both the following seasons, no other manure being given in the interval. Taking both years' crops together, the value of crop produced per ton by the richer dung was not more than 1*s.* 3*d.* greater than that produced by the poorer manure. The value of this increase is not one-half of the difference in value (2*s.* 10*d.*) of the two lots as estimated from the chemical analysis. It seems most unlikely that the difference will be recovered in a reasonable number of years.

In the second season the manures were applied (at the rate of 12 tons per acre) in autumn, 1910, to different plots of ground which were in 1911 cropped with swedes. The yield of roots per acre was greater in the case of the richer manure by 23 cwt. This gives an increased yield of about 2 cwt. from a ton of the rich manure, as compared with the poorer. This cannot be valued at much more than 9*d.*, which is but a fraction of the difference per ton (3*s.* 11*d.*), estimated from the chemical composition of the two lots. It is concluded that—

(1) The difference in composition between the manures produced by animals fed on different rations may differ widely from that which the composition of the foods consumed might lead one to expect, especially where the amounts of "roots" included in the rations differ greatly. (2) The chemical composition of the manures is not by itself a reliable measure of their relative values. The differences in value realised in crop returns were well below those calculated from the chemical composition in the ordinary way.

The difference between the estimated manure values of the two rations was too small to justify drawing definite conclusions as to how far it was recovered in crop increases, but the opinion is expressed that a vast amount of investigation remains to be carried out before fully satisfactory methods of computation of manure values can be devised, if indeed such can be devised at all.

Heavy Root Feeding and the Dung-heap (*Trans. Highland and Agric. Soc. of Scotland,* 1911; *Mr. James Hendrick*).—In fattening cattle in the Aberdeen district comparatively small quantities of concentrated foods are used—as a rule not more than 4 to 6 lb. per head per day—but large quantities of turnips are fed. The ordinary allowance for a bullock of 8 to 10 cwt. live weight is from 100 to 120 lb. of turnips a day. Such a quantity necessitates the consumption of far more water than the animal really requires, as, in spite of the widespread belief as to their superiority over those grown elsewhere, Aberdeen turnips are not found on analysis to contain less than the average amount of water. Previous experiments have shown that bullocks consuming 56 lb. of turnips a day did not show a desire for more water, so that animals consuming a hundredweight of roots a day are receiving at least five gallons of water daily in excess of their requirements. This excess has to be got rid of through the urine, and naturally the urine of such animals is poorer than that of animals receiving less quantities of water. Furthermore, it requires a large quantity of litter to absorb 60 or 80 lb. of urine per head per day, and much of it is wasted, particularly in the case of cattle fed in byres, as few farms boast the possession of liquid manure tanks. These facts have an important bearing on the quality of dung made where heavy root feeding is carried on, and also on the manurial value recovered from the feeding stuffs used.

In connection with experiments carried out by the Aberdeen and North of Scotland College of Agriculture, several analyses of dung and of liquid manure were made. The percentage composition in each case was found to be considerably lower than what is regarded as normal. It is concluded that none of the methods commonly employed in estimating the manurial values of foods fed on the farm are applicable to farms where heavy root feeding is practised. They all greatly overestimate the value actually recovered by the farmer, in at least cases where the liquid manure is allowed to run to waste.

Effect of Manganese as a Catalytic Manure (*Die Landw. Versuchs Stationen, lxxvii., Heft. I. and II.*).—Experiments conducted by Professors Pfeiffer and Blanck with carbonate and sulphate of manganese on oats in pots gave inconclusive results, though the manganese caused an increased assimilation of nutritive substances from the soil.

Field experiments were then carried out on a heavy clay soil under oats, to which a complete dressing of artificials had been given. Manganese sulphate was applied at the rate of 9, 18, and 27 lb. per acre, but no beneficial effect on the crops was obtained.

Sulphate of manganese was found, however, to have a beneficial action on mangolds, sown after the oats. The increase in the crop varied from 24 to 101 cwt. per acre, the maximum increase being obtained with 54 lb. of sulphate of manganese per acre.

Sulphur as a Manure (*Bull. Bur. Agric. Int. and Pl. Dis., May,* 1912).

—Experiments in France and Germany with sulphur as a manure are summarised in this publication.

Pot experiments were made by Boullanger in France, with carrots, beans, celery, lettuce, sorrel, chicory, potatoes, onions, and spinach. The effect of adding flowers of sulphur was to increase the weight of produce by from 10 to 40 per cent. When the soil had been previously sterilised the increase produced by the application of sulphur was, however, very considerably less. It thus appears that the sulphur acted chiefly indirectly, modifying the development of the micro-organisms of the soil.

In experiments carried out in France by Demolon, residues from the purification of coal gas were applied to the soil in such quantity as to supply 92 lb. of sulphur per acre, with very favourable results on swedes, parsnips, mangolds, and turnips. In these cases the results seemed to point to an effect of sulphur on the chlorophyll, in addition to that on the soil organisms.

Experiments in Germany confirmed the efficacy of sulphur against potato scab. Mangolds were found to benefit from applications of sulphur, especially with a complete dressing of artificials.

FEEDING STUFFS.

Soy Bean Meal for Pigs (*Fühlings Landw. Ztg., June 15th,* 1912).—In feeding experiments carried out in 1909, soy bean meal, when included in a ration for fattening pigs, produced very satisfactory increases in live weight, the increase being produced at a less cost with the soy bean meal than with either barley meal or sesame cake.

The suitability of soy bean meal for fattening swine was confirmed by experiments in the winter of 1911–12, when a ration containing slightly more than half a pound per head per day of the meal produced a satisfactory live weight increase, the cost of production again being less than with a similar ration in which barley meal took the place of soy bean meal.

Fat tests were carried out, and the compositions of the fats resulting from feeding with the two rations were found to be practically identical.

WEEDS.

Eradication of Cleavers (*Arb. Deut. Land. Gesell., Heft* 203, *Stück* 5).—Experiments carried out with various spraying materials, including sulphate of iron, nitrate of soda, sulphate of ammonia, and nitrate of lime, were not attended with much success, and it is concluded that eradication of the weed is best undertaken by special cultivation of the soil, and by the growth of cleaning crops, such as potatoes and turnips. In order to prevent introduction of the weed, clean seed should be used, and in connection with the separation of the seeds of *Galium Aparine* from those of cereals, mention is made of the method practised in the districts bordering on the North Sea of cleaning rape seed by running over a cloth, when the fruits of cleavers stick to the cloth.

MISCELLANEOUS.

The Cricket-bat Willow (*Kew Bulletin of Miscellaneous Information,* No. 4, 1912).—A paper published in the *Kew Bulletin,* 1907, p. 311, and reported in this *Journal* for November, 1907, p. 461, dealt with the identity of the forms of Salix, of which the timbers are most prized by cricket-bat makers. It was there shown that the best of all willows for bat-making is a pyramidal-growing, female form of the blue willow (*Salix alba* var., *coerulea*), which, except for recent plantings, is only found in a few East Anglian counties. An interesting and important question which, for want of data, could not then be decided, was as to whether the restriction of the best cricket-bat willow to these eastern counties was due to its being a local variety, or perhaps hybrid, possessing by inheritance those peculiar qualities which the cricket-bat maker desires; or, whether those qualities were due to, and dependent on, local conditions of climate or soil. As is well known, the East Anglian climate is the driest and sunniest in the United Kingdom, and it was by no means certain in the opinion of several competent observers that the timber of the cricket-bat willow would retain its peculiar value if it were produced, say, in the warm, humid climate of Cornwall or in the somewhat similar conditions of the west of Scotland. Large numbers of cricket-bat willows have been planted in such districts during the past five years, and it has become important to ascertain how far the labour and expense incurred is likely to be recompensed.

An encouraging report is given of some timber of cricket-bat willow grown on the estate of Mr. J. Arthur Campbell, at Arduaine, Lochgilphead, Argyllshire. Mr. Campbell, for experimental purposes, made a plantation of about 150 trees in 1903 and 1904. One of these, planted in 1904, having attained a diameter in its trunk of 6 or 7 in., he cut down and sent to Mr. D. J. Carter, willow dealer of Newtown, Waltham Cross, Herts, to ascertain its suitability and value for bat-making. Mr. Carter reported that it was perfectly satisfactory, and if of proper size for cricket-bat making (48 in. in circumference) would have fetched the normal price per cubic foot. This timber, having been grown under a rainfall of about 60 in. per annum, as compared with a rainfall of under 25 in. in East Anglia, appears to afford sufficient proof that its peculiar virtues are inherent and not necessarily dependent on its environment.

It need hardly be said that cutting down trees of the size of the one noted above is wasteful. So much greater is the proportion of woody tissue deposited on the trunk as the tree increases in size that, even allowing for compound interest, a loss is incurred by felling trees before they are 1½ to 2 ft. in diameter of trunk.

In the article on this willow in the *Kew Bulletin* of 1907, it was suggested that its qualities were probably due to its remarkable vigour of growth. Whether this be so or not, there is no doubt that the timber of rapidly grown trees is better for the bat-maker's purpose, and of greater value per cubic foot, than that of slowly grown, comparatively stunted trees. The best bat-maker's timber is that in which the annual rings are not less than ½ in. wide. Trees on poor or comparatively dry ground will bring in neither so quick nor so large a return per cubic foot of timber as those grown on better, moister soil. This is a matter that should receive attention when a site is selected; further, any attention to the welfare of young trees will be repaid. Mr. Campbell believes that manuring the roots will prove profitable.

Distribution of the Nitrogen of Wheat between the Flour, Bran, and Shorts (*Journ. Agric. Sci., June,* 1912; *Mr. G. C. Greaves and Mr. R. Stewart, Utah Expt. Sta.*).—A large number of milling tests with different varieties of wheat were carried out, and the weight and composition of the different products were recorded. Taking the average results from 58 varieties, wheat when milled gave 68·10 per cent of flour, 22·89 per cent. of bran, and 9·03 per cent of shorts. It was found that the proportion of nitrogen in the wheat was no direct index of the amount which its flour would contain. The proportion of the protein recovered in the flour varied from 56·84 per cent. to 65·56 per cent., and the amounts occurring in the bran and shorts varied similarly. In an average of 222 determinations with 42 varieties, the protein of the wheat was divided between the flour, bran, and shorts in the proportion of 61·87, 27·98, and 9·92 respectively.

Prevention of Damage by Frost in Orchards (*Nevada Agric. Expt. Stn., Bull. No.* 79).—Experiments were carried out in 1911 on two orchards of 19 and 250 trees respectively. The minimum temperature recorded during the experiments was 24·7° F. in the case of the first orchard, and 22° F. in the case of the second. Temperature was kept up by creating a thick smoke by burning oil in vessels holding about three gallons each. At the first orchard 24 "heaters" were used, and eight heatings were required, the longest lasting 7 hours. The amount of oil consumed was 358 gallons, or 18·7 gallons for each tree protected. At the second orchard, 200 "heaters" were employed, and thirteen heatings were necessary, the longest lasting 10 hours. The amount of oil consumed was 4,125 gallons, or 13·7 gallons for each tree protected.

With a few exceptions the protected trees of the first orchard were heavily laden with fruit, while those in a neighbouring orchard beyond the range of the smoke were barren. At the second orchard apple trees did well, but other fruit trees suffered severely from frosts before the experiments were commenced.

At the first orchard the total cost of the eight heatings was 4*s.* per tree; at the second orchard the thirteen heatings cost 3*s.* per tree. Importance is attached to the provision of efficient hedges round the orchard to maintain the pall of smoke during a strong wind, or to ensure an economical heating in calm weather.

OFFICIAL NOTICES AND CIRCULARS

Outbreaks of Foot-and-Mouth Disease.

Foot-and-Mouth Disease was reported on June 23rd to exist at Belmount, near Penrith, Cumberland. A veterinary inspector of the Board visited the suspected premises and found 16 cows affected with the disease. Instructions were given for the immediate slaughter of all animals on the farm, and an Order was issued prohibiting the movement of all animals over a wide area around the infected premises. Local Authorities throughout Great Britain were warned that the disease had again appeared in this country.

On June 27th information was received that Foot-and-Mouth Disease had been discovered amongst animals slaughtered in the abattoirs at Liverpool. The diagnosis was confirmed by the Board's Chief Veterinary Officer. There appeared to be no reason to doubt that the animals had been exposed in Stanley Market, Liverpool, on Monday, June 24th, and that they were affected with disease at the time. The majority of the animals in the market were of Irish origin, and inasmuch as it is a distributing centre from which animals are moved to other markets, it seemed probable that the disease had been carried to ot [illegible]s. Steps were taken to trace definitely the place of origin and [illegible]on of all the animals in the market. The Board issued an Order prohibiting the landing of cattle, sheep, goats, and swine in Liverpool, or their movement within that city. Restrictions were also imposed on the movement of animals or the holding of markets within a radius of 15 miles of Liverpool. On June 28th an Order was issued prohibiting the landing in Great Britain of animals from Ireland. Further outbreaks were confirmed on June 29th in Liverpool, and among a herd of Irish cattle at Harraby, near Carlisle.

On June 30th an outbreak of disease occurred near Wakefield, and the Board made an Order prohibiting the exhibition of cattle, sheep, goats, and swine at the Royal Agricultural Society's Show at Doncaster.

On July 1st an outbreak was confirmed in a herd of dairy cows at Knotty Ash, Liverpool, in close proximity to Stanley Market, and a further outbreak occurred in the West Riding of Yorkshire at Barnsley.

Up to July 2nd four main disease centres had developed, viz. :—(1) Cumberland; (2) Lancashire and Cheshire; (3) West Riding of Yorkshire; and (4) Northumberland and part of Durham, whilst a number of further outbreaks have subsequently occurred in these areas.

On July 6th a fresh centre of disease was discovered at Old Malden, in Surrey, where pigs were found to be affected, and, in consequence, the Board made an Order prohibiting the movement of animals within a radius of approximately 12 miles of Malden. This area embraced the whole of the county and City of London, and the Order had the effect of prohibiting the exposure of stock at Islington Cattle Market.

By July 8th 38 outbreaks of disease had been confirmed.

Prohibition of Importation of Animals from Great Britain into Ireland.

The Board of Agriculture and Fisheries have been informed by the Department of Agriculture and Technical Instruction for Ireland that, in consequence of the confirmation by the Board on the 24th June of the existence of Foot-and-Mouth Disease in Cumberland, the Department have prohibited, until further notice, the importation of ruminant animals and swine into Ireland from Great Britain.

Turning Out of Entire Animals on Commons.

The Board of Agriculture and Fisheries have made their first Order under the Commons Act, 1908, confirming regulations relating to the turning out of entire animals on the Eppynt Hills, Breconshire. The principal object of the regulations is to prevent any person from turning out an entire horse, pony, or ass on the Hills until it has been inspected and marked by persons authorised by a committee consisting of representatives of the Commoners and of the Lords of the Manors concerned.

Fream Memorial Prize.

The Board of Agriculture and Fisheries have awarded a Fream Memorial Prize of the value of £7 1s. 9d. to Mr. John Malcolm, of Dunmore Farm, Larbert, Stirlingshire, a student of the West of Scotland Agricultural College, Glasgow, who obtained the highest marks in the recent examination for the National Diploma in Agriculture.

The Agricultural Output of Great Britain.

The Board of Agriculture and Fisheries have recently published a report on inquiries made by them in connection with the Census of Production Act, 1906, relating to the total output of agricultural land, the number of persons engaged, and the motive power employed.

The report includes particulars as to the estimated production of farm crops, flowers, and fruit, cider and perry, timber, crops under glass, animals, meat, wool, dairy produce, and poultry. A differentiation is made as regards the output from the several classes of holdings, and an account is given of the labour and motive power employed on farms.

The Report may be obtained from Messrs. Wyman and Sons, Ltd., Fetter Lane, E.C., price 9*d.*

Advisory Council on Horse breeding.

A meeting of the Advisory Council on Horse Breeding, appointed by the President of the Board of Agriculture and Fisheries, was held on Thursday, June 27th, at the offices of the Royal Agricultural Society of England, 16 Bedford Square, W.C., under the chairmanship of Lord Middleton. Among those present were the Earl of Erroll, Viscount Helmsley, Lord Arthur Cecil, the Hon. Alexander Parker, Colonel the Hon. Charles Byng, Sir Merrik R. Burrell, Bart., Sir Gilbert Greenall, Bart., C.V.O., Major-General J. F. Brocklehurst, C.V.O., C.B., Mr. Algernon Turnor, C.B., Captain M. S. Adye, Mr. David Davies, M.P., Mr. Tresham Gilbey, Colonel H. Lewis, Mr. J. L Nickisson, Captain Dealtry C. Part, Mr. C. W. Tindall, Mr. J. R. Campbell (an Assistant Secretary of the Department of Agriculture and Technical Instruction for Ireland), Professor Sir J. McFadyean, and Prof. J. Penberthy.

The Board were represented by Mr. A. W. Anstruther, C.B., an Assistant Secretary; Mr. J. McCall, Assistant Veterinary Officer; Mr. F. W. Carter, a Superintending Inspector; and Mr. E. B. Shine; and the War Office by Colonel Fowle, C.B.

Mr. E. B. Wilson and Mr. A. B. Charlton, Joint Secretaries to the Council, were also present.

The Chairman submitted for the information of the Council a report of the proceedings of the Standing Committee, which was confirmed by the Council.

Lord Arthur Cecil, Viscount Helmsley, and Captain M. S. Adye were elected members of the Standing Committtee of the Council.

Mr. Anstruther, in making a report of the proceedings of the Board to the Council, referred to the great loss sustained by the Council owing to the death of Major Fife-Cookson, whose knowledge of the thoroughbred stallion had been invaluable to them. He explained that the Preliminary Report of the Board as to the administration of the light horse-breeding grant, which was now in course of preparation, would shortly be available. A brief account of the principal points dealt with in the Report was given as follows:—Of the 50 King's Premium stallions in 1911, 46 "travelled" and four "stood" at their respective headquarters. The total number of mares served was 3,245, of which 625 received free nominations. The amount paid by the Board in service fees was £6,232, such fees being exclusive of the Premiums of 50 guineas each paid by the Board on award (£2,625) and of the foal fees to be paid during the present year. A special Pony Committee, under the chairmanship of Lord Arthur Cecil, has now been appointed by the President to advise him as to the best methods to be adopted in future for the improvement of mountain and moorland breeds of ponies, more especially those which roam at large.

As the original grant of £10,000 for the purchase of brood mares in 1911 had already been expended, the Board obtained the sanction of the Treasury in the autumn of that year to expend a similar sum in respect of the 1912 season. Approximately £20,000 was granted to 37 County Committees, who up to May 31st, 1912, had purchased 375 mares. The majority of the mares inspected by the Board's officers have been reported as being considered suitable for the purposes in view, and those reported as being unlikely to breed progeny of the type desired have been recommended for disposal. In addition, the War Office were good enough to sell to the Board 20 artillery mares of substance and quality, which have been leased out to suitable custodians through the agency of five County Committees, and as to which the Board had received excellent reports.

Grants of £400 each were made by the Board to the County Committees of Carmarthenshire and Pembrokeshire for the encouragement of the Welsh roadster, and a similar grant of £400 to the Committee for Inverness-shire for the improvement of the breed of Highland pony. Similar proposals have been under consideration in respect of the Devon packhorse, but the Board, from the information at their disposal, have so far been unable to proceed with the scheme.

As regards the registration of stallions by the Board, the following information was given. From November 1st, 1911, to May 31st, 1912, 708 stallions had been registered, as against 313 for the period from March 1st, 1911, to October 31st, 1911. The 708 stallions included 60 Hackneys, 18 Hunter stallions, and 170 Thoroughbreds; 56 Clydesdales, 246 Shires, and 36 Suffolks; the balance including more than 100 pony stallions, and also Arabs, Cleveland bays, and Yorkshire coach horses.

In connection with the Registration Scheme, the Board are at present in communication with the National Veterinary Association as to drafting a schedule of diseases acceptable to the veterinary profession as a whole, whereby a generally recognised standard of soundness might be adopted. If such a standard can be authoritatively established the Board hope that all Agricultural Breed Societies will accept as sound, horses holding the certificate of the Board, who would in turn recognise those issued by the Breed Societies.

A general discussion on the operation of the Horse-breeding Scheme followed.

On the motion of Major-General Brocklehurst, the Standing Committee were invited again to consider the advisability of fixing an age limit for soundness in respect of stallions.

The Council then proceeded to discuss a special reference to them from the President of the Board of Agriculture and Fisheries as to the expediency of controlling by legislative enactment the travelling of stallions other than those which had received an official certificate of soundness and suitability for breeding purposes. Mr. J. R. Campbell, of the Irish Department, explained the position taken up by the Irish Advisory Council in this matter, and ultimately it was resolved to refer the question to the Standing Committee of the Council for further consideration, the majority of the Council appearing to be strongly in favour of the suggested legislation.

In response to the invitation of the Chairman, Captain Dealtry C. Part gave a short account of the Mendelian experiments which he was conducting at his own expense in consultation with Major C. C. Hurst, one of the scientific members of the Council, and Mr. F. W. Carter.

Warning as to Wart Disease of Potatoes.

The Board of Agriculture and Fisheries desire to inform potato growers that a case of Wart Disease of potatoes (*Synchitrium endobioticum*, Percival) has occurred in Cheshire, and to remind them that all cases of this disease must be reported to the police or other officers appointed by the Local Authority for the purpose. Notifications may be sent to the Board, who will forward them to the proper quarter.

The Board desire also to warn potato growers that in view of the rainfall of the past month, the potato disease caused by *Phytophthora infestans*, De Bary, may be expected before long to attack the potato crop, and they recommend that crops should be sprayed with Bordeaux mixture at once.

This disease is not required to be notified.

Leaflets as to both the above-named diseases may be obtained, free of all cost, on application to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W. Letters so addressed need not be stamped.

Notes on the Weather in June.

The weather during the *first* week of June (June 2nd to June 8th) was very unsettled, and except in the extreme north and north-west of Great Britain rain was experienced very frequently, sometimes in considerable amounts. Temperature was below the normal, the deficit being more than 2° in several English districts. "Very heavy" falls of rain were recorded in England N.E., S.W., and the Midland Counties; elsewhere (except in Scotland N.) the falls were "heavy." The amount of sunshine experienced was "scanty" or "very scanty" everywhere.

During the *second* week, the weather remained in an extremely changeable condition, with frequent falls of rain in all districts.

Warmth was "deficient" in Scotland N. and E., and "moderate" in all other districts. Rainfall was largely in excess of the average in most districts, but in England E. the excess was slight, and in the English Channel there was a considerable deficit. Bright sunshine was very deficient in Scotland; in the English districts the duration was nearly normal, but in England E. it was considerably in excess of the average.

The weather in the *third* week was extremely unsettled in the western and northern districts, with frequent heavy rain in the west of Scotland. Over the south-eastern quarter of England a decided improvement took place after the beginning of the week, the weather in the last few days being mostly fair and dry. Temperature was above the average in most of the English districts, but in the west and north of Scotland it was considerably below it. Rainfall was "light" in England S.E., "heavy" in England N.E. and N.W., and "moderate" in other parts of England. Bright sunshine exceeded the average in England E. and S.E., but was "deficient" in all other districts.

The weather during the *fourth* week was generally cool and extremely unsettled. Temperature was mostly below the normal. Rainfall was above the average in all districts except Scotland N. Except in England S.E. a deficient amount of bright sunshine was recorded.

Agricultural Conditions in Great Britain in June.

The Crop Reporters of the Board, in reporting on agricultural conditions on July 1st, report that the results of the wet weather, which has prevailed generally during the month, may be, on the whole, described as beneficial; sufficient rain has, however, now fallen, and sunshine is wanted. Corn crops have, in the more southern districts, generally improved, but the wet seems to have affected them rather adversely in the northern half of the country. Wheat is generally healthy, but often a thin plant; on the whole, it should nearly reach an average. Barley also can only be described as barely average; it would seem to be better in the north and west than in the great corn-growing counties of the east. Oats are very poor, and by far the worst of the cereals; many fields have failed and been ploughed up, while frit fly has caused much damage. Only in some districts in the north and south-west are good crops expected. Peas are better than beans, the former being about 2 per cent. above average and the latter as much below.

Potatoes are doing fairly well throughout the country, and a crop rather over the average is looked for; comparatively little disease is mentioned, though reports of slight attacks come from most districts. The mangold crop also is expected to be somewhat over average; the poorest reports—indeed, some bad reports—come from the east of England, but elsewhere these roots are generally satisfactory. Of the prospects of turnips and swedes it is as yet too early to speak; some sowing still remains to be done.

There is much difference this year between the abundance of permanent grass and of the clovers and rotation grasses. The crop from the latter is generally bad, some districts anticipating only half a crop.

Here and there some good crops are to be looked for; but, except in the north and west, they are the exception. Meadow-hay, on the other hand, will probably nearly reach an average, some bad crops in the east and south-east being nearly balanced by promising yields in the north and south-west. The progress of hay-making has been much delayed, and fine weather is required, in some cases to cart hay already cut, but in most districts to allow of cutting.

Hops are generally healthy and looking well, but genial weather would be welcomed. Washing, to keep down the fly, has generally been heavy and continuous, especially in the south-eastern counties. On the whole, a yield just about average is expected.

Among the small fruits, gooseberries seem to be the best; strawberries have generally been short, raspberries will probably be a little below average, and currants nearly average. Apples seem very variable, but the crop looks like being a short one upon the whole; pears are generally better; while cherries are about average. Plums are nearly everywhere short.

Live stock have on the whole done fairly well during the month, although, like the crops, they would now be the better for fine weather. Pastures have been very generally improved by the rains, and the grass on them is now fairly plentiful, but in several districts they are still rather bare.

Summarising the returns, and expressing an average crop by 100, the prospects on July 1st indicated probable yields in England and Wales which may be denoted by the following percentages:—Wheat, 99; barley, 99; oats, 90; beans, 98; peas, 102; potatoes, 102; mangolds, 101; seeds' hay, 91; meadow hay, 99; hops, 100.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for June, 1912, issued by the International Institute of Agriculture, contains official information received up to June 18th. It states that during May cold and wet weather prevailed in many parts of Europe, with hail in Belgium, Switzerland, and the alpine regions of Austria. Over-average cereal crops, however, are still expected, although the prospects are not quite so good this month as last. In *Germany* the condition of winter and spring wheat is estimated at 2·3, winter rye at 2·6, spring rye at 2·4, spring barley at 2·2, and oats at 2·4 (1=very good, 2=good, 3=average, 4=bad, 5=very bad). In *Austria*, using the same scale, the condition of rye, barley, and maize is estimated at 2·3, wheat at 2·1, and oats at 2·4. In *Belgium*, hail and insect pests have done some damage, and crops of from 5 to 8 per cent. over-average are now expected. Wheat has improved in *Denmark*, and barley and oats promise to be average crops. Rye, however, has suffered from the low temperature. Weather conditions have been unfavourable in *Spain*, and the yields of wheat, barley, and oats will, on present appearances, be considerably below the average. The condition of rye is good. Rain has been beneficial in *Bulgaria*, winter and spring crops are in good condition, and the yields are expected to be average. In *France*, rains at the end of May have counteracted the harmful effects of the drought of the previous three weeks, and the condition of wheat, oats, and rye is estimated at 75, barley at 76, and maize at 65 (80=good, 60=fairly good). In *Hungary*, the oat crop has suffered from floods and the wheat from rust. There is, however, promise of yields 5 per cent. over average for wheat, average for barley and oats, and 2 per cent. over average for rye. If the present unfavourable weather continues in *Italy* the harvest will be smaller than that of last year. Field work has been done under favourable conditions in *Norway and Sweden*. In *Switzerland*, in spite of damage by hailstorms, the condition of the crops is fairly good.

In *Canada* the weather has been cold and wet, and in the east large areas still remained to be seeded at the end of May. Winter wheat has suffered in Ontario and Alberta. In *Tunis* the oat crop has suffered severely from the sirocco, and it is estimated that the yield of this cereal will be reduced by 10 per cent. In *Egypt* the yield per acre is estimated at 26·5 bush. for winter wheat and 30·5 bush. for barley.

Servia.—The following table shows the final returns of 1911 compared with those of 1910:—

Crop.	AREA.		PRODUCTION.	
	1911.	Difference per cent. in 1911 from 1910.	1911.	Difference per cent. in 1911 from 1910.
	acres.	%	Quarters.	%
Wheat	954,571	+0·2	1,913,437	+19·8
Rye	123,218	−1·2	199,546	+25·6
Winter Barley...	254,593	−4·3	552,902	+14·4
Oats	258,789	−3·1	517,833	+16·5
Maize	1,442,638	+0·2	3,094,435	− 8·8

New Zealand.—The following table gives the latest figures of area and production of the cereal crops in 1911–12, showing comparisons with last year's figures:—

Crop.	AREA.		PRODUCTION.	
	1911–12.	Difference per cent. in 1911–12 from 1910–11.	1911–12.	Difference per cent. in 1911–12 from 1910–11.
	acres.	%	Quarters.	%
Wheat	215,428	−33·1	989,176	− 4·5
Barley	31,628	− 5·5	156,633	+35·2
Oats...	403,479	+33·3	2,457,882	+94·3
Maize	6,091	−53·3	32,384	−52·3

Sugar Beet.—The area under this crop in France, Belgium, and Denmark is greater this year than last, and about the same as last year in Italy. The yield is expected to be average in Roumania, Bulgaria, and Spain, over average in Belgium, and under average in the Netherlands, where considerable damage has been done by insect pests. In *Servia* the area under sugar beet in 1911 was 11,263 acres, as compared with 10,522 acres in 1910. The production was 13,674 tons, or 121·6 per cent. of the production in 1910, when 11,244 tons were obtained. (*Bull. of Agric. Statistics*, June, 1912.)

Live Stock Census in Luxemburg.—At the census of December 10th, 1910, the number of cattle was reurned at 94,183, or 9 per cent. less than at the previous census of December 2nd, 1907; horses, 18,625, or 1·2 per cent. less; sheep, 5,580, or 34 per cent. less; and pigs, 128,035, or 4·5 per cent. less than in 1907. (*Bull. of Agric. Statistics*, June, 1912.)

United States.—The Statistician of the Department of Agriculture has issued the following report as to the condition of the crops:—

Winter Wheat.—The condition of the crop on June 1st was 74·3 per cent., which compares with 79·7 on May 1st, 80·4 a year ago, 80·0 two years ago, and 80·9 the ten years' mean.

Spring Wheat.—The average condition of spring wheat on June 1st is returned at 95·8 per cent., which compares with 94·6 last year, 92·8 two years ago, and 93·8 the ten years' mean. The total area under spring wheat this year is 19,201,000 acres, which compares with 20,381,000 acres reaped last year.

Oats.—The average condition of oats is 91·1 per cent. At this time in 1911 it was returned as 85·7, in 1910 at 91·0, in 1909 at 88·7, the ten years' mean being 88·4. The area this year is returned at 37,844,000 acres, which compares with 37,763,000 acres harvested last year.

Barley.—The condition of barley is placed at 91·1 per cent., as against 90·2 this time last year, 89·6 two years ago, and 90·6 three years ago. The yield of barley this year is estimated at 192,000,000 bush., compared with 174,000,000 bush. last year.

Rye.—The condition of rye is estimated at 87·7, as against 87·5 a month ago, and 88·6 this time last year.

(*Broomhall's Corn Trade News*, June 10th, 1912.)

Fruit Crops in Germany, France, Belgium and Holland.

The Board of Agriculture and Fisheries have received the following reports from his Majesty's Consuls on the condition of the fruit crops in certain districts in Germany, France, Belgium, and Holland:—

Germany.—H.M. Consul-General at Frankfort-on-Main, writing (June 26th) on prospects in Germany, reports that this year's crop of nearly all kinds of fruit in Germany will presumably be a small one. The fruit trees and bushes have suffered heavily through the great drought of 1911, subsequently through the sudden change of temperature from warmth to intense cold in February, and, finally, through the spring frosts in April and at the beginning of May. The blossoms were exceptionally numerous, but for the most part they could not survive such adverse conditions. In many districts a complete failure of the fruit crops is certain. In the district of Bühl in Baden, the centre of the early "Zwetschgen" plum cultivation, the loss sustained by the proprietors of vineyards and orchards is estimated at from £50,000 to £100,000. Insect pests are doing great damage throughout the country, and in many neighbourhoods the fruit trees are also suffering from vegetable parasites, which are favoured by the changeable weather.

The following summary for various German provinces gives a concise view of the prospects of the fruit crop throughout the country:—

East and West Prussia.—All fruit trees, but particularly nut trees, have suffered from severe weather. Recent rain has improved the prospects, and gooseberries are setting well. In East Prussia, plums are medium; in West Prussia, inferior to bad.

Posen.—The amount of blossom was very unequal, but after rain the condition has improved. Early plums, sweet cherries, gooseberries, currants and raspberries, have suffered from frost, but a medium crop is expected.

Silesia.—So much damage has been done by frost that the setting fruit has for the most part fallen. The later kinds appear in medium condition, and half a crop is looked for. Plums are good to medium.

Schleswig-Holstein and Hamburg.—Apples are only setting in small quantities, but pears plentifully. Half the early strawberry crop was destroyed by frost at the end of April. Gooseberries and currants also suffered heavily. Plums are bad.

Mecklenburg.—Stone fruit, apples, and pears have all suffered from frost. The promising gooseberry crop was almost totally destroyed while in blossom. Sweet cherries, blooming after the frost, have not suffered. Plums are inferior.

Hanover.—Although blossom was plentiful, little fruit has set owing to frosts in April and May. Strawberries, cherries, early apples, and pears have, in places, been completely destroyed. Autumn and winter apples, however, are setting very well. Plums are inferior.

Westphalia and Lippe.—Blossom was exceptionally plentiful, but owing to damage by frosts, especially to the early fruit, only a medium crop is expected. Hail in May destroyed the fruit crops in certain districts. Insect pests are appearing extensively. Plums are inferior to middling.

Brandenburg.—Buds at the end of April suffered from cold, but not so seriously as in other districts. The crop of every kind of berry fruit is a failure. Plums are medium to inferior.

Thuringian States.—In the districts of Römfeld and Hildburg early apples, pears, cherries, plums, and walnuts suffered severely from frosts, but in the later district of Hildburghausen practically no damage was done. In the former districts the fruit is setting moderately, in the latter well. Plums are medium to inferior.

Province of Saxony.—The gooseberry and currant bushes have suffered severely from last year's drought, caterpillars and repeated frosts. Apricots and all early cherries were nipped by frost, and also the later kinds in low-lying localities, but those in the higher orchards were excellent. Apples and pears also suffered from frosts in May. Of all the fruit crops that of Zwetschgen plums has the best prospects, although even they can only be described as medium.

Kingdom of Saxony.—Blossom was very plentiful, but was greatly damaged by frosts. Apricots, plums, and sweet cherries suffered most. The early currants were completely destroyed by frost, but the later kinds may produce a medium crop. In the later higher localities a medium crop of apples and pears is expected. A heavy storm at the beginning of May caused severe damage in several districts. Plums are inferior to medium.

Hesse.—The low-lying localities have suffered from frost. In more elevated districts a satisfactory crop is expected, except for peaches and apricots. Plums are medium.

Rhine Province.—The damage done by late frosts does not seem so serious in this province as in other parts of Germany. With the exception of stone fruit, hazel nuts, and walnuts, a medium crop is expected. Plums are inferior.

Bavarian Palatinate.—In most districts, owing to frosts, the early crop is a complete failure. In higher localities, however, the fruit is setting well. Plums are medium to inferior.

Hesse-Nassau.—Last year's drought has greatly hindered the development of fruit, especially berries. Apples, pears, and stone fruit had plenty of blossom, but, except in elevated positions, comparatively little set. In the higher districts stone fruit promises a medium crop. Plums are very variable, the Zwetschgen variety being the better.

Bavaria.—Nearly all fruits have suffered extensively from frost. In the Bavarian foothills, however, not so much damage was done, and the fruit has set very well. Plums are inferior to medium.

Baden.—On account of cold and snow, the fruit has set in only small quantities. The buds of plums, mirabelles, and cherries were mostly frozen in the winter. In the later Pforzheim district apples have set plentifully. Pears will be below average; stone fruit generally is bad, although Zwetschgen plums from Buhl promise better. The quantity of currants is very small, of gooseberries a little larger. The best crops will come from the higher localities. From many parts, especially round Lake Constance, much damage by insect pests is reported.

Alsace Lorraine.—All fruit buds of peaches, apricots, quinces, and walnuts were destroyed by frost in February. Stone fruit was also largely affected, and apples and pears have suffered to a less degree. In the Weissenburg district apples, Zwetschgen plums, and mirabelles promise very well. Plums generally are inferior.

More local reports from H.M. Consuls on prospects in their own districts are as follows:—

In *Pomerania* the severe winter greatly damaged peach, apricot, and walnut trees. Cherry crops are estimated to be small. Pear crops will only be good in the higher districts; elsewhere medium crops are expected. Apples are average, but have suffered from frost. Plums are average to small. All berry fruit will be scarce, owing mainly to the very dry summer of 1911.

The outlook in *Wurtemberg* is on the whole bad, and prices will probably rule high. Only of apples and pears is any export to be looked for. The cherry crop has been almost a total failure, and the same will be the case with peaches and apricots. Late apples will be more abundant than the early varieties. Zwetschgen plums in some districts will be above the average, but in most they will be a total failure. The crop will probably barely meet home consumption, and the Wurtemberg market will have to rely on Baden. Plums, greengages, and mirabelles promise well in very few places, and it will be necessary to import largely.

France.—Generally speaking, there is a great shortage in every kind of fruit for exportation. There will only be available for export to the United Kingdom this year at most half the ordinary available quantities of pears, cherries, apricots, and apples; but of prunes, peaches, and black currants there will only be one-third, if as much, and their price will probably be about one-third higher than last year. The plum crop will be bad. (Paris, June 25th.)

Belgium (Antwerp, June 24th).—Prospects are very meagre. Early frosts destroyed the bloom, and the subsequent prolonged period of drought hindered the formation of the fruit. The crop is likely to be poor in quality and restricted in quantity.

Holland.—According to official reports, fruit prospects are generally satisfactory. Plums, however, have been damaged by night frosts, and in the districts of Westland, Voorne, and Putten gooseberries have suffered considerably from fungoid attacks. Currants vary, but on the whole are very good. Gooseberries are expected to give moderate yields, while raspberries are good to very good everywhere, except in the province of Groningen. Grapes under glass are very good everywhere; those in the open are fairly good. Peaches under glass are moderate on the whole; those in the open are bad, except in Westland, where the condition is from good to very good. General complaints are heard of the unfavourable condition of strawberries, which is attributed to the dry summer of 1911. (June 18th and 22nd.)

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on July 1st, 1912, certain diseases of animals existed in the countries specified:—

Austria (*for the period June 19th—26th*).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 315 Höfe now infected), Glanders and Farcy, Rabies, sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (*for the period May 1st—15th*).

Anthrax, Blackleg, Foot-and-Mouth Disease (12 "foyers" in 8 "communes"), Rabies.

Bulgaria (*for the period June 6th—14th*).

Anthrax, Glanders and Farcy, Rabies, Swine Fever.

Denmark (*month of May*).

Anthrax, Foot-and-Mouth Disease (50 cases), Swine Erysipelas.

France (*month of May*).

Anthrax, Blackleg, Foot-and-Mouth Disease (684 "étables" in 277 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (*for the period June 1st—15th*).

Foot-and-Mouth Disease (1,781 infected places in 634 parishes), Glanders and Farcy, Swine Fever.

Holland (*Month of May*).

Anthrax, Foot-and-Mouth Disease (18 outbreaks in 7 provinces), Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (*for the period June 12th—19th*).

Anthrax, Foot-and-Mouth Disease (total of 77 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (*for the period May 20th—26th*).

Anthrax, Foot-and-Mouth Disease (76 new cases entailing 2,071 animals), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (*for the period May 1st—15th*).

Foot-and-Mouth Disease (16 "étables" infected in 8 "communes").

Norway (month of May).

Anthrax, Blackleg, Swine Fever.

Roumania (for the period June 5th—13th).

Anthrax, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (month of February).

Anthrax, Foot-and-Mouth Disease (2,553 animals in 72 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period May 11th—18th).

Glanders and Farcy, Rabies, Sheep-pox.

Spain (month of March).

Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (48,239 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of April).

Anthrax, Blackleg, Foot-and-Mouth Disease (2 outbreaks), Swine Fever.

Switzerland (for the period June 10th—16th).

Anthrax, Blackleg, Foot-and-Mouth Disease (64 "étables" and "pâturages" entailing 1,669 animals, of which 10 "étables" and "pâturages" were declared infected during the period), Swine Fever.

Agricultural Labour in England during June.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in June:—

Hoeing, weeding, singling roots, and, in the more southern counties, haymaking, provided a fair amount of work for men outside the regular farm staff during June. According to the reports received, the rain which fell during the month did not generally cause much loss of time to such extra labourers, except in parts of the northern and south-western counties. There was a surplus of these men in a few districts, but in most cases the supply was about balanced by the demand.

Northern Counties.—Extra labourers lost several days through rain in most districts, but were otherwise fairly well employed, being in demand for hoeing and weeding operations and for singling roots. The supply of men was generally sufficient for requirements; some scarcity of men for hoeing was, however, reported in the Howden (*Yorkshire*) Rural District, while a surplus of extra men was reported in the Clitheroe (*Lancashire*), Patrington and Sherburn (*Yorkshire*) Rural Districts.

At the Whitsuntide hirings in Cumberland, Westmorland, and North Lancashire an upward tendency in wages was indicated, correspondents in Westmorland reporting increases of from 10*s.* to 30*s.* for the half-year; women workers were generally scarce.

Midland Counties.—With the exception of a few districts in which an interruption from rain was reported, employment was fairly regular for extra labourers in these counties, particularly towards the end of the month, when haymaking had begun.

The supply of extra men was generally balanced by the demand; some excess, was, however, reported in parts of the Evesham (*Worcestershire*) and Alcester (*Warwickshire*) Rural Districts, while in the Stone (*Staffordshire*) and Daventry (*Northamptonshire*) Rural Districts there was a scarcity of such men. Carters were wanted in the Pershore (*Worcestershire*) Rural District, while a scarcity of men for permanent situations was also reported in the Daventry (*Northamptonshire*) Rural District.

Eastern Counties.—There was a good deal of hoeing to be done among the root crops in these counties, and extra men were reported in regular employment throughout the month in most districts. Several correspondents, however, referred to a reduced demand for men for haymaking on account of light crops, and the supply of such men was occasionally in excess of requirements.

Southern and South-Western Counties.—Haymaking was somewhat hindered by rain in several districts, particularly in the south-western counties, and some time was lost by extra men in consequence. The supply of and the demand for such men were otherwise generally about equal in these counties. A scarcity of men for permanent situations was reported in certain districts in *Sussex, Wiltshire, Gloucestershire,* and *Cornwall.*

THE CORN MARKETS IN JUNE.

C. KAINS-JACKSON.

Wheat.—Prices have ceased advancing, and before the month closed there were signs favourable to buyers. In France the price at which millers were securing new wheat for delivery within the months of July and August was fully five shillings per quarter below that which was ruling for old corn. Antwerp prices were (prompt delivery) 39*s*. 3*d*. per 480 lb., September delivery, 36*s*., while Argentine wheat held for 39*s*. per 480 lb. at Mark Lane, and was obtainable for July shipment and August arrival at 35*s*. to 35*s*. 6*d*. If buyers had these agreeable figures before them, there were no indications of a general break-up of firmness. Canada was not offering forward terms appreciably lower than spot values, and the United States were holding their old winter wheat at 37*s*. per 480 lb., and not offering new crop under 36*s*. The Indian new crop wheat was not offered for prompt shipment under 38*s*. for red, 39*s*. for fine white, while the Russian crop was not easily obtainable for autumn shipment at all. This was the more remarkable as advices to the shipping lists, which so largely influence the importers of corn, indicated a probable yield of ninety million quarters, a very striking increase on the yield of last year. Something like a stable equilibrium is indicated by the main statistics of supply and demand for 42 completed weeks of the cereal year. The supply of British and imported breadstuffs for that period stood at 26,432,000 qr., while 42 weeks' requirements at the usual estimate of 630,000 qr. weekly, would be 26,860,000 qr. Stocks of imported wheat in the fifteen chief ports stood on June 30th at almost exactly two million quarters, as compared with 1,465,000 qr. a year ago, but these figures included as "arrived" considerable quantities in vessels in the Thames estuary awaiting discharge.

The supply on passage was 3,300,000 qr., including flour, and was almost identical in total with the return for a year previously. Millers, however, noted that there were difficulties in store for them not revealed by these "aggregates." Only 85,000 qr. of Russian and S.E. European wheat are in sight, against 235,000 qr. a year ago. Increased expectations of Californian will not replace the Russian type in the mill, and it is doubtful how far Indian will do so. Increased supplies of Canadian on passage are very welcome, though unfortunately less than usual of it is of the finer milling type. June shipments of wheat were 2,452,000 qr. from North America; 1,585,000 qr. from South America; 1,202,000 qr. from India; 941,000 qr. from Russia; 539,000 qr. from Europe S.E.; and 207,000 qr. from Australasia. A large increase in shipments from Canada, the United States, and India, and a marked decline in Russian shipments, distinguish June, 1912, from June, 1911, but with famine reported in four provinces, the surprise perhaps is rather that Russia shipped wheat at all. British wheat at the statute markets has lasted out fairly well, but old crop is always scarce after May, and prices have been easily maintained. London has nearly touched 40*s*., while in the last week of the month Cambridge averaged 38*s*. 2*d*., Reading, 38*s*., and Chichester as much as 39*s*. Value in East Anglia was very level, Ipswich, Norwich, and Peterborough all returning an average of 37*s*. 10*d*. per qr.

Flour.—London mills usually give us the most convenient flour averages in their "official" prices for top-grade, Town Whites and Town Households. But during June the difficulty of getting wheat from the arrived ship into the mill, and of getting flour from the mill to the suburban bakehouse, has led to much confusion in prices, and it will be best to take Liverpool values, which, on the last market of the month, were 33*s*. 6*d*. for best English, 30*s*. for ordinary English patents, 28*s*. 6*d*. for English first bakers', 32*s*. 6*d*. for spring wheat patents, 27*s*. for good bakers' grade, and 29*s*. 6*d*. for Canadian spring patents. These prices argue no great change on the month. The American mills are already offering to ship in a month from order flour ground from the new winter wheat just beginning to be reaped in the central wheat belt of the United States. This is called Kansas, even when not grown in that State. The word, like another, "Manitoba," has come to indicate a type as much as a region. This winter wheat flour is mentioned at 28*s*. per sack c.f.i. to London. The shipments of flour from North America for June were 413,000 sacks.

Barley.—British samples have been extremely scarce. Imported barley has been inclined to favour buyers, as the Indian shipments have completely relieved the apprehensions as to July supply. The spot price of Russian in London has been maintained at 30*s*., owing to difficulties of securing prompt delivery. At the end of the month, Russian new crop was sold freely for October delivery at 22*s*. per 400 lb., or 8*s*. under the spot price. The British farmer will do well to keep his deliveries of barley in October down this year, at least where it is not up to 424 lb. or higher weight.

June shipments of barley were 79,000 qr. from North America; 829,000 qr. from Russia; 38,000 qr. from Roumania; and 991,000 qr. from India. The latter is a record shipment. Some cargoes have also been cleared from Persia. There are 255,000 qr. in all on passage. The Indian is very uniform in price: 28*s.* to 29*s.* per 400 lb. Malt has been a quiet, firm trade; brown 37*s.*, best 48*s.* per qr.

Oats.—High averages have continued to be recorded for British oats. London's mean for the month is 25*s.* 9*d.*, and in the last week of trade 24*s.* 5*d.* was averaged at Manchester, 24*s.* 9*d.* at Salisbury, and 25*s.* 11*d.* at Reading. Fine New Zealand and good Canadian oats have also commanded good prices; 24*s.* to 26*s.* has been about their range. Foreign oats have made 22*s.* to 23*s.* for Russian, which have been scarce, but Argentine, the sort in greatest supply, have been obtainable at 19*s.* per 304 lb., and are even cheaper for delivery a fortnight hence. June shipments were 237,000 qr. from Canada, 1,092,000 qr. from La Plata, 424,000 qr. from Russia, and 10,000 qr. from New Zealand. There were, on the 30th, 590,000 qr. on passage.

Maize.—Holders of spot maize in a position to deliver it to customers have been getting really high prices—36*s.* to 38*s.* per qr. within the London five-mile radius. Throughout England generally 30*s.* has been about the lowest port, 32*s.* the lowest inland, price. While this has been so, the futures market has given way 2*s.* on the month, and cargoes for summer shipment, offered at 25*s.* 6*d.* on the 1st, were obtainable for 23*s.* 6*d.* on the 29th. The lowest price is 23*s.*, for September shipment from Buenos Aires; remoter futures are rather higher than lower. The shipments of the month were 2,853,000 qr. from Argentina, 356,000 qr. from Russia, and 813,000 qr. from Europe S.E. The quantity on passage on the 30th was 1,160,000 qr., which is much above the average.

Oilseeds.—English rapeseed has been in particularly good demand for sowing purposes, and 96*s.* per qr. has been paid for best, 88*s.* for ordinary. Linseed has been obtainable at a slight reduction; Argentina in June shipped 387,000 qr., and India 332,000 qr. The supply on passage is 235,000 qr. Cottonseed shows little change; business is chiefly of a speculative character, price for Egyptian new crop for November shipment being £8 12*s.* 6*d.* per ton c.f.i. to London.

Various.—By-products of the mill fell rather sharply during the month, but there was some recovery before the close. Canaryseed advanced fully 4*s.* per qr. during the thirty days. Beet-sugar experienced a notable decline, and was eventually pressed on sale at 11*s.* per cwt. Soy beans were very firm; 9*s.* per cwt. is now being asked, and £8 15*s.* per ton is paid for cargoes. Soy bean cakes are, in proportion, not dear at £7 per ton for cash. India is sending us new crop chick peas at 30*s.* per 504 lb.; Rangoon is asking 47*s.* per 504 lb. for haricot beans, new crop. Buckwheat, of which the English supply has held out fairly well, is quoted at 30*s.* for Russian, 33*s.* for Cambridgeshire. French and Canadian buckwheats, often in very fair supply, do not seem to be at present on offer.

THE LIVE AND DEAD MEAT TRADE IN JUNE.

A. T. MATTHEWS.

Fat Cattle.—In the English markets the coming of June may be said to mark the opening of a new season, when the cattle begin to appear from the pastures. Notwithstanding the scanty growth of the grass, cattle have evidently thriven very well, for the general condition of the animals has been good for the time of year. Grass-fed beasts have been brought forward in large numbers, especially from Ireland, whence good supplies have come at an earlier date than usual, and this, together with the thundery weather, which on many occasions has led to caution on the part of buyers, has at least checked the advance in prices which had so steadily prevailed for many weeks. Until the last week, however, values were well maintained, and even then the fall that occurred was too small to bring down the monthly averages, which work out slightly higher than in May. In Scotland trade has been remarkably good, and live-weight quotations have been considerably higher than those of English markets, owing chiefly to the fact that the Scottish markets have still been supplied with stall-fed cattle. As instances of extreme rates, it may be recorded that prime Shorthorns were quoted at 10*s.* 3d. at Newcastle, and 10*s.* *2d.* at Islington, per 14 lb. stone, which is equal to 8¾*d.* per lb.

The following are the breed averages for the month:—Shorthorns, 9*s.* *6d.* for first and 8*s.* *6d.* for second quality, against 9*s.* *5d.* and 8*s.* *6d.* in May; Herefords, 9*s.* *9d.* and 8*s.* *8d.*, against 9*s.* *8d.* and 8*s.* *9d.*; Devons, 9*s.* *4d.* and 8*s.* *5d.*, against 9*s.* *4d.* and 8*s.* *3d.*; Polled Scots, 9*s.* *10d.* and 9*s.* *3d.*, against 9*s.* *8d.* and 8*s.* *10d.* The few Welsh Runts which were sold at the end of the month averaged 9*s.* *6d.* and 8*s.* *8d.* per stone. There are not many of this breed as yet on the market.

Veal Calves.—Fat calves are naturally plentiful at this time of year, but veal is generally in great demand. Trade in June was somewhat slow, and prices rather lower than at last year's corresponding date. They declined also slightly from those of May, and the averages were 8¼*d.* and 7¼*d.* per lb.

Fat Sheep.—There has been a marked improvement in the condition of the sheep on offer, and supplies have been fairly good. Business was quiet, and prices showed a downward tendency, though the actual fall was little more than fractional. It is curious to note that the small decline was almost entirely confined to the sheep classed as Downs, Longwools only losing ¼*d.* per lb. on second quality. The former in about twenty-two English markets averaged 8¾*d.*, 7¾*d.*, and 6¼*d.* per lb. for the three qualities, against 9*d.*, 8¼*d.*, and 6¾*d.* in May, and Longwools averaged 8½*d.*, 7½*d.*, and 6*d.*, against 8½*d.* 7¾*d.*, and 6*d.* A good many heavy sheep were shown at Islington, but they met a very dull trade, and large numbers were unsold in the market, Scarcely any Scotch sheep came to the metropolitan market this month, and these were much missed. The strongest demand in London is for small sheep of prime quality, such as the South Downs and Scotch half-breds

Fat Lambs.—The supply of lambs again exceeded the demand, and, in London at least, the trade in them was remarkably slow. Only a small proportion were of the required small weight, and well fattened, and a large number sold at Islington at mutton prices. It is difficult to account for such large offerings of coarse lambs in low condition now that there is plenty of keep and greatly improved prospects for a turnip crop. There was again a considerable fall in prices, and in about forty-three markets of England and Scotland the averages for the month were 10*d.* and 9*d.* per lb., against 11½*d.* and 10*d.* in May. Prices in Scotland were much higher than in England, otherwise the average would have been still lower.

Fat Pigs.—The upward movement in the value of bacon pigs steadily continued till the last week, when there was some decline. The average prices were 7*s.* 2*d.* per 14 lb. stone for prime small, and 6*s.* 6*d.* for heavier pigs. Bacon pigs were relatively dearer than porkers, and Birmingham quotations have generally been the highest.

Carcass Beef—British.—There was a very firm, steady trade for fresh-killed beef in London all the month, though prices were a little lower in the last week in sympathy with the live-stock markets. Prices all ruled higher on the average by about 3*d.* per 8 lb. stone on Scotch and 1*d.* on English. They were as follows:—Scotch short sides, 5*s.* 6*d.* and 5*s.* 4*d.*; long sides, 5*s.* 2*d.* and 5*s.*; English, 4*s.* 10*d.* and 4*s.* 8*d.* per stone. There is again considerable complaint of the condition of much of the Scotch beef on arrival, and this is said to be due to the want of refrigerating cars for safe transit.

Port-Killed Beef.—Supplies at Deptford of American cattle have again been very moderate, and the sides in the Central Market realised an average of 4*s.* 8*d.* to 4*s.* 10*d.* per stone, being quite equal in market value to the English. It should, however, be borne in mind that the English beef consigned to the dead-meat market scarcely represents the primest quality.

Chilled Beef.—The fact that Argentine beef was, on the whole, considerably cheaper than in May, shows how little the markets were affected by the strike. Supplies were fully equal to demand, and average prices declined 6*d.* per stone on best hindquarters. They were 3*s.* 3*d.* and 3*s.* for hindquarters, and 2*s.* 7*d.* and 2*s.* 5*d.* for fores.

Frozen Beef.—The trade in frozen beef was quiet, and of a steadier character than that for chilled, and there was very little difference in their value. The best hindquarters generally fetched 3*s.* per stone, and forequarters were comparatively high. On one occasion New Zealand frozen fores actually fetched 2*s.* 7*d.*, against 2*s.* 6*d.* for Argentine chilled.

Carcass Mutton—Fresh-Killed.—Scotch mutton is not largely offered in London in June, and in the third week it was scarcely in quotable quantity. There were fair supplies of Dutch, which largely fills the place of Scotch, though fetching lower prices. Scotch averaged 5*s.* 8*d.* and 5*s.* 4*d.* for first and second quality, English 5*s.* and 4*s.* 10*d.*, and Dutch 4*s.* 11*d.* and 4*s.* 8*d.* per stone. These prices show a reduction of ½*d.* per lb. on those of May.

British Lamb.—The carcass lamb trade can only be described as very bad as regards English lamb. Prices only averaged 5*s.* 7*d.* and

5*s*. 3*d*., against 6*s*. 4*d*. and 5*s*. 10*d*. in May. A few prime Scotch sold at 6*s*. 4*d*., but few have yet arrived.

Frozen Mutton and Lamb.—Frozen mutton was amply supplied, and prices were about unchanged. The top price of the best New Zealand was 3*s*. 2*d*. per 8 lb. Lamb was relatively dear, and prime Canterbury ranged between 4*s*. 8*d*. and 4*s*. 10*d*. per stone.

Veal.—The best veal, starting at 5*s*. 4*d*., declined to 4*s*. 8*d*., and was a slow trade throughout.

Pork.—The small quantity sold was steady in value, being quoted all the month at 4*s*. to 4*s*. 4*d*. for both English and Dutch.

THE PROVISION TRADE IN JUNE.

HEDLEY STEVENS.

Bacon.—This trade has been very slow, and, in consequence, prices have shown a steady fall. These conditions have been chiefly brought about by the strike of transport workers, some dealers having suffered heavy losses through the detention of their perishable goods, others accordingly being very careful in their operations. Those who held any available stock reduced their prices with a view to forcing business, but their efforts met with little response. The consumptive demand for hams this summer has so far been unusually small. although American hams are selling at over one penny per lb. cheaper than in June last year. This has doubtless been caused by the unseasonable weather.

The arrivals of long sides from Denmark and Russia have not been large, but more than sufficient for the demand, and there have been complaints as to the stale condition of some of the Russian arrivals through the goods being detained on account of the strike at the London docks. Shipments from the United States and Canada continue below the average, but as a result of the small demand, stored stocks have increased in this country during the month.

Hogs in Canada are a little cheaper, and the receipts at the various packing centres in America continue much larger than expected. Prices on the Chicago market ranged from $7.00 to $7.80 during the month, against $5.75 to $6.50 for the same time last year, and $8.75 to $9.75 two years ago.

Prices for English pigs remain steady. There appear to have been more bacon pigs available during June than was anticipated, and unless the consumptive demand improves, present prices cannot be maintained.

Cheese.—Prices have dropped several shillings on the month, but in the case of new Canadians the fall was not as great as was anticipated.

Dealers have acted very cautiously, especially in contracting Canadians, as with the large English make in progress they do not see a chance of a profit at the prices demanded by the Canadian shippers, which at the end of the month were from 60*s*. to 63*s*. c.i.f. for June makes. At the same time last year, the same description of goods was being sold at from 53*s.* to 54*s.* c.i.f. On account of the backward season in Canada, the shipments from that country to June 30th were below those of last year, but for the past few weeks the weather conditions have been good, and a large make should result.

The estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 83,000, against 118,000 at the same time last year, and 178,000 two years ago.

Prices for New Zealand makes were retained unduly high early in the month owing to the difficulty in getting supplies from the vessels in dock through the strike, and were about 14*s.* to 15*s.* per cwt. above those current at the same time last year. At the end the month, however, the difference had increased to 8*s.* or 10*s.* above last year's prices. Spot values of new Canadians are now about 9*s.* per cwt. above the current rates at the same time last year.

There is still a large make going on in this country, milk being plentiful. The demand has been principally for the lower-priced or factory descriptions, farmers' cheese being comparatively slow of sale.

Butter.—This has again been a dragging trade, and prices have shown a drop of 2*s.* to 3*s.* per cwt. each week during the month.

The shipments from Australia and New Zealand are now reduced almost to a minimum, and there has been very little demand even for the small quantities on each steamer. Irish butter has been the best value on the markets, and the demand for this has been brisker than for any other description. Siberians have not been arriving in large quantities, as the shippers have been delaying their consignments at the ports of shipment owing to the labour difficulties at the London docks, so that it is probable that the arrivals from Siberia during the next few weeks will be heavy, and that prices will fall still lower, especially as milk is still so plentiful at home, and large quantities of butter are being made for local requirements.

The following extract from a recent issue of the *Montreal Trade Bulletin* shows that it is very unlikely that we shall have any shipments from Canada for some time to come:—

"A year ago a good export demand for butter set in from Great Britain, the shipments for the week ending June 16th, 1911, being 7,670 packages to commence with, and in the last week in August they increased to 18,459 packages. At the close of navigation they amounted to 134,503 packages, against 27,884 packages for the corresponding period of the year previous. Of course, the conditions to-day are quite different from those of a year ago, when choicest creamery butter was selling in this market at 1½ cents to 2 cents lower than prices now ruling, the latter being 2 cents to 3 cents above an export basis. Prices will have to advance about 5*s.* to 10*s.* per cwt. on the other side or drop 1½ cents to 2½ cents per lb. here before any business can be done."

Eggs.—At the beginning of the month prices were reduced all round, but later advanced gradually. The demand has been chiefly for the cheaper grades, as prices are above the normal, but from the present outlook there does not seem to be any chance of a reduction.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of June, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England.		Scotland.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 10	9 3	46 4	41 10
Herefords	9 9	8 8	—	—
Shorthorns	9 6	8 6	45 2	40 11
Devons	9 4	8 5	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	8¼	7½	9	7¼
Sheep:—				
Downs	8¾	7¾	—	—
Longwools	8½	7½	—	—
Cheviots	9½	8¾	9¾	8½
Blackfaced	9	8¼	9	7¾
Cross-breds	8¾	8	9¾	8¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	7 4	6 9	6 9	5 11
Porkers	7 5	6 11	7 3	6 6
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	21 8	17 18	24 4	19 0
,, —Calvers... ...	21 1	17 6	20 14	17 4
Other Breeds—In Milk ...	19 10	15 15	19 6	16 2
,, —Calvers ...	14 10	14 0	18 13	16 5
Calves for Rearing	2 7	1 16	3 0	2 4
Store Cattle:—				
Shorthorns—Yearlings ...	9 18	8 7	11 0	9 3
,, —Two-year-olds...	14 16	12 12	16 15	13 17
,, —Three-year-olds	18 5	16 3	18 6	14 10
Polled Scots—Two-year-olds	—	—	17 4	14 19
Herefords— ,,	15 15	13 17	—	—
Devons— ,,	14 2	12 2	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	38 3	34 0	—	—
Scotch Cross-breds ...	—	—	36 4	31 1
Store Pigs:—				
8 to 10 weeks old	17 3	13 6	21 3	17 4
12 to 16 weeks old	27 6	21 4	26 0	18 0

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of June, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Liverpool.		London.		Manchester.		Edinburgh.		Glasgow.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
BEEF :—													
English	1st	64	6	64	0	67	6	63	6	69	0*	68	0*
	2nd	60	0	61	0	65	6	60	6	63	6*	65	6*
Cow and Bull ...	1st	55	6	55	6	52	0	54	0	57	0	57	6
	2nd	48	6	51	6	47	0	48	6	49	0	52	6
U.S.A. and Canadian :—													
Port Killed ...	1st	—		66	0	67	6	—		—		—	
	2nd	—		62	0	65	0	—		—		—	
Argentine Frozen—													
Hind Quarters...	1st	42	6	42	0	41	6	42	0	41	6	41	6
Fore ,, ...	1st	35	0	33	0	35	6	33	0	34	6	36	0
Argentine Chilled—													
Hind Quarters...	1st	46	0	45	0	46	0	45	0	48	0	50	0
Fore ,, ...	1st	36	0	36	0	36	6	36	0	37	6	36	6
Australian Frozen—													
Hind Quarters...	1st	42	0	40	0	40	6	40	0	—		40	0
Fore ,, ...	1st	34	6	32	6	34	6	32	6	—		33	0
VEAL :—													
British	1st	66	0	74	6	70	0	70	0	—		66	6
	2nd	57	0	70	0	64	0	64	6	—		62	0
Foreign	1st	—		—		70	0	—		72	6	66	6
MUTTON :—													
Scotch	1st	—		79	6	79	6	77	0	79	6	85	0
	2nd	—		74	6	74	6	73	0	68	0	63	0
English	1st	70	6	73	6	70	6	73	0	—		—	
	2nd	57	6	67	0	67	6	67	6	—		—	
Argentine Frozen ...	1st	38	0	39	6	36	0	39	0	37	0	37	6
Australian ,, ...	1st	38	0	37	6	37	6	37	6	—		35	0
New Zealand ,, ...	1st	38	6	—		41	0	—		—		37	6
LAMB :—													
British	1st	76	6	79	6	78	0	79	6	90	0	94	6
	2nd	71	6	71	6	73	6	73	6	79	6	85	0
New Zealand ...	1st	65	6	64	6	66	6	64	0	67	6	64	6
Australian	1st	60	0	58	6	61	0	58	6	—		57	0
Argentine	1st	59	6	58	6	58	6	58	6	58	6	57	0
PORK :—													
British	1st	62	6	56	0	60	6	59	6	57	0	58	0
	2nd	58	0	51	6	56	0	55	0	50	6	55	6
Foreign	1st	—		—		60	6	—		—		—	

Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6 ...	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
,, 13 ...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
,, 20 ...	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
,, 27 ...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3 ...	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
,, 10 ...	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
,, 17 ...	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
,, 24 ...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2 ...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
,, 9 ...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
,, 16 ...	32	6	30	1	34	0	23	6	24	11	31	2	18	0	17	6	21	8
,, 23 ...	32	9	30	2	34	1	23	7	25	0	31	10	17	11	17	5	21	9
,, 30 ...	33	0	30	3	34	4	23	8	24	11	30	3	18	0	17	5	21	8
Apl. 6 ...	33	6	30	4	34	10	23	1	24	7	30	9	17	11	17	7	21	11
,, 13 ...	33	7	30	3	35	4	23	5	25	2	30	2	18	3	18	3	22	1
,, 20 ...	33	7	30	4	36	7	23	0	25	5	29	11	18	3	17	10	22	4
,, 27 ...	33	0	30	11	37	10	22	10	25	5	30	4	18	3	18	3	22	9
May 4 ...	32	6	31	4	38	1	22	7	25	7	30	2	18	2	18	6	23	1
,, 11 ...	32	1	31	8	37	11	22	0	25	1	31	1	18	1	19	0	23	7
,, 18 ...	31	10	32	6	37	8	21	8	25	4	31	2	17	8	19	2	23	7
,, 25 ...	31	3	32	8	37	2	21	4	25	0	31	1	17	10	19	5	23	7
June 1 ...	30	2	32	5	36	10	21	8	24	10	30	0	17	10	19	5	23	9
,, 8 ...	29	1	32	4	36	11	20	9	25	7	29	11	17	10	19	7	24	0
,, 15 ...	29	0	32	3	37	0	18	11	23	11	30	8	18	0	19	8	23	10
,, 22 ...	29	4	31	11	37	5	20	1	23	9	30	8	17	9	19	10	24	0
,, 29 ...	29	9	31	10	37	10	19	11	24	5	30	2	17	7	19	9	23	11
July 6 ...	30	4	32	1	38	2	19	5	25	10	31	7	17	4	19	9	23	11
,, 13 ...	31	1	32	3			21	3	25	10			17	7	19	11		
,, 20 ...	31	11	32	5			19	9	24	3			17	5	19	5		
,, 27 ...	33	5	32	5			20	10	23	8			18	1	19	7		
Aug. 3 ...	33	9	32	0			20	5	24	4			18	3	18	2		
,, 10 ...	33	5	31	6			20	4	26	9			18	0	18	0		
,, 17 ...	32	11	31	6			20	11	27	8			17	11	17	10		
,, 24 ...	32	7	31	8			20	10	28	10			17	2	18	0		
,, 31 ...	32	2	31	7			22	10	28	4			17	2	18	3		
Sept. 7 ...	31	11	31	10			23	3	28	4			17	2	18	1		
,, 14 ...	30	11	32	0			24	3	29	0			16	6	18	5		
,, 21 ...	30	2	32	4			24	2	29	11			16	3	18	9		
,, 28 ...	30	1	32	6			24	4	30	5			16	4	19	1		
Oct. 5 ...	30	1	32	7			24	7	30	9			16	3	19	5		
,, 12 ...	30	2	32	9			25	1	31	0			16	2	19	10		
,, 19 ...	30	4	32	9			25	3	31	5			16	1	19	11		
,, 26 ...	30	4	33	1			25	4	31	7			16	2	20	6		
Nov. 2 ...	30	4	33	4			25	6	31	10			16	2	20	8		
,, 9 ...	29	11	33	4			25	4	32	7			15	11	20	11		
,, 16 ...	29	8	33	1			25	1	32	10			16	1	21	0		
,, 23 ...	29	11	33	0			24	10	33	5			16	4	20	10		
,, 30 ...	30	6	32	10			24	7	33	10			16	7	20	11		
Dec. 7 ...	30	9	32	9			24	3	34	0			16	9	20	9		
,, 14 ...	30	7	32	11			23	9	33	5			16	10	20	9		
,, 21 ...	30	7	32	9			23	10	33	5			16	9	20	8		
,, 28 ...	30	5	33	0			23	9	33	4			16	9	20	7		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1911.	1912.	1911.	1912.	1911.	1912.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d*
France:	May	46 9	52 8	27 2	30 9	22 8	24 6
	June	46 8	54 5	27 4	31 2	22 9	24 11
Paris:	May	49 3	54 0	25 7	29 9	23 11	25 2
	June	47 2	56 1	27 0	29 11	23 11	25 5
Belgium:	April	32 10	38 0	24 7	31 10	20 8	26 3
	May	34 11	39 4	24 11	31 9	21 10	27 0
Germany:	April	40 7	47 0	29 6	36 2	23 1	28 4
	May	42 5	48 7	29 2	34 5	24 2	28 10
Berlin:	April	42 10	48 9	—	—	22 3	28 0
	May	44 4	49 6	—	—	23 2	28 0
Breslau:	April	38 1	43 9 {	27 7* 23 7†	— 30 6†	} 20 11	26 4
	May	39 7	44 10 {	— 24 9†	— 31 11†	} 22 7	26 4

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of June, 1911 and 1912.

—	Wheat.		Barley.		Oats.	
	1911.	1912.	1911.	1912.	1911.	1912.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London...	32 9	38 5	25 1	—	20 2	25 9
Norwich	32 8	36 10	23 4	30 8	19 6	23 11
Peterborough	31 5	36 10	24 10	29 9	19 1	23 8
Lincoln...	3 2	36 6	—	30 2	19 1	24 0
Doncaster	31 9	36 5	23 10	29 8	19 5	23 7
Salisbury	31 6	36 8	21 11	31 7	19 11	24 2

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of June, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	14 0	12 0	—	—	13 0	12 0	14 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	112 0	108 0	110 0	107 0	114 0	112 0	109 0	—
,, Factory ...	105 6	101 0	105 6	99 6	107 6	105 0	—	—
Danish ...	—	—	121 6	118 6	122 6	120 6	118 6	—
French ...	—	—	—	—	126 0	122 0	—	—
Russian ...	111 6	107 6	109 6	105 6	110 0	107 0	106 0	—
Australian ...	112 0	108 0	—	—	111 0	107 6	—	—
New Zealand	116 0	114 0	—	—	115 6	113 6	—	—
Argentine ...	110 0	108 0	—	—	114 0	112 0	—	—
CHEESE:—								
British—								
Cheddar ...	84 0	78 0	78 6	76 0	74 0	70 0	68 6	66 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	66 6	59 6	72 6	68 6	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	69 0	67 0	67 6	66 6	71 0	69 6	66 0	—
BACON:—								
Irish	74 0	70 6	74 0	68 0	77 0	74 0	69 6	—
Canadian ...	68 0	66 0	66 0	63 6	68 6	66 0	67 6	65 6
HAMS:—								
Cumberland ...	—	—	—	—	101 6	90 0	—	—
Irish	—	—	—	—	98 0	91 0	105 0	103 0
American (long cut)	66 0	62 0	65 6	61 0	74 0	71 0	64 0	—
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	9 2	8 4	—	—	10 5	9 2	10 5	—
Irish	8 10	8 5	8 9	8 1	9 0	8 4	8 9	8 1
Danish ...	—	—	9 6	8 11	9 5	8 2	9 10	9 4
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
Edward VII.	71 0	60 0	48 6	41 6	63 6	55 0	—	—
Langworthy ...	65 0	50 0	66 6	61 6	83 6	73 6	60 0	55 0
Up-to-Date ...	62 0	45 0	43 6	36 6	64 6	55 6	50 0	45 0
HAY:—								
Clover ...	115 0	105 0	120 0	102 0	114 0	93 6	100 0	95 0
Meadow ...	110 0	100 0	—	—	109 0	88 0	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	JUNE.		SIX MONTHS ENDED JUNE.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	48	65	497	476
Animals attacked	54	91	556	594
Foot-and-Mouth Disease :—				
Outbreaks	4	—	4	1
Animals attacked	38	—	38	18
Glanders (including Farcy) :—				
Outbreaks	19	16	88	104
Animals attacked	39	32	188	273
Parasitic Mange :—				
Outbreaks	183	—	2,100	—
Animals attacked	379	—	4,686	—
Sheep-Scab :—				
Outbreaks	4	6	162	303
Swine-Fever :—				
Outbreaks	390	316	1,797	1,332
Swine Slaughtered as diseased or exposed to infection ...	4,978	4,180	22,841	14,977

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	JUNE.		SIX MONTHS ENDED JUNE.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	—	—	2	5
Animals attacked	—	1	2	6
Glanders (including Farcy) :—				
Outbreaks	—	1	—	2
Animals attacked	—	1	—	3
Parasitic Mange :—				
Outbreaks	8	6	45	44
Sheep-Scab :—				
Outbreaks	8	6	258	242
Swine-Fever :—				
Outbreaks	27	14	137	63
Swine Slaughtered as diseased or exposed to infection ...	155	158	1,275	974

SELECTED CONTENTS OF PERIODICALS.

Live Stock—

Uber die Verwertung der Trockenhefe durch die landwirtschaftlichen Nutztiere, *W. Voltz, J. Paechtner* und *A. Baudrexel.* (Landw. Jahrb., XLII. Band, Heft 2, 1912.) [63.604(*a*).]

Dairying and Food, General—

Taette, die urnordische Dauermilch und verwandte Milchsorten, sowie ihre Bedeutung für die Volksernährung, *Dr. O. J. Olsen-Sopp.* (Centbl. Bakt. [etc.], 2e Abt., 33 Bd., No. 1–6, 17 Februar, 1912.) [576.8; 63.71.]

Birds, Poultry, and Bees—

A Year's Work in the Apiary, *D. M. McDonald.* [63.81(04).] The Food of Birds, *Laura Florence.* [59.162.] (Trans. Highland and Agr. Soc. Scot., Vol. XXIV., 1912.)

Forestry—

Über den Einfluss verschiedener Belichtung und extremer Temperaturen auf den Verlauf der Keimung forstlichen Saatgutes, *Dr. Gottfried Pittauer.* (Centbl. Gesam. Forstw., April, 1912.) [63.49 : 58.]

Die ökonomischen Aufgaben der Forstwirtschaft mit besonderer Berücksichtigung der preussischen Staatsforsten, *Dr. Martin.* (Tharand. Forstl. Jahrb., 63 Band, 2 Heft, 1912.) [63.49(04); 63.49(43).]

Die Prüfung des Kiefernsamens, *Haack.* (Ztschr. Forst u. Jagdw., April und Mai, 1912.) [63.492.]

Experiments on Trees at Colesborne, *H. J. Elwes* and *H. A. Pritchard.* [63.49(04).] The Structure of the Timbers of some Common Genera of Coniferous Trees, *W. S. Jones.* [63.49–198; 63.492.] Growing Larch for Profit, *Sir W. Schlich.* [63.492.] (Quart. Jour. Forestry, Vol. VI., No. 2, April, 1912.)

Untersuchung von märkischen Dünensandböden mit Kiefernbestand, *K. Vogel von Falckenstein.* (Internat. Mitt. Bodenkunde, Band I., Heft 6, 1912.) [63.12; 63.492.]

Engineering—

An Improved Roof for the Cow-House, *Richard Henderson.* [63.6 : 69.] The Farm Stable, *C. W. Sleigh.* [63.6 : 69.] (Trans. Highland and Agr. Soc. Scot., Vol. XXIV., 1912.)

ADDITIONS TO THE LIBRARY.

Field Crops—

India, Memoirs of the Dept. of Agriculture, Chemical Series.—Vol. II., No. 3 :—The "Rab" System of Rice Cultivation in Western India. (141–191 pp.) Calcutta, 1912. Re. 1. [63.319.]

Suriname, Departement van den Landbouw.—Bull. 25 :—De rubbercultuur op het Maleische Schiereiland. (138 pp.) Paramaribo, 1910. [63.347.]

U.S. Dept. of Agriculture.—Farmers' Bull. 483 :—The Thornless Prickly Pears. (20 pp.) Washington, 1912. [63.33(*d*).]

Bangor, University College of North Wales.—Bull. VIII., 1911 :—Growth of Linseed. (3 pp.) Bangor, 1912. [63.342.]

Oklahoma Agricultural Experiment Station.—Bull. 97 :—Cotton Culture. (23 pp.) Stillwater, Oklahoma, 1912. [63.34113.]

*Board of Agriculture and Fisheries.**—Report on Experiments in the Cultivation of Sugar Beet in 1911. [Cd. 6162.] (56 pp.) London: Wyman & Sons, 1912. 5*d*. [63.3432.]

Kentucky Agricultural Experiment Station.—Bull. 155 :—Wheat; (1) Variety Tests; (2) Cultural Directions; (3) Treatment of Diseases. (33–60 pp.) 1911. [63.24–31; 63.311.] Bull. 161 :—Soy Beans. (104–132 pp.) 1912. [63.604(*a*).] Lexington, Kentucky.

University of Leeds.—Bull. 83 :—The Influence of Time of Cutting upon the Yield and Composition of Hay. (14 pp.) Leeds, 1912. [63.198.]

South-Eastern Agricultural College, Wye.—The Growing of Tobacco for Nicotine Extraction, Part II. (53 pp.) 1912. [63.295; 63.3461.]

India, Memoirs of the Dept. of Agriculture, Botanical Series.—Vol. IV., No. 4 :—The Inheritance of Red Colour, and the Regularity of Self-Fertilisation, in *Corchorus Capsularis,* Linn., the Common Jute Plant. (73–92 pp.) [63.341.] Vol. IV., No. 5 :—Observations on Certain Extra-Indian Asiatic Cottons. (93–112 pp. + vii. plates.) [63.34113.] Calcutta, 1912.

South Dakota, Agricultural Experiment Station.—Bull. 133 :—Alfalfa as a Field Crop in South Dakota. (255–281 pp.) Brookings, South Dakota, 1911. [63.33(*c*).]

Unstead, J. F.—The Climatic Limits of Wheat Cultivation, with Special Reference to North America. (46 pp.) [The Geographical Journal, April and May, 1912.] [63.311.]

California Agricultural Experiment Station.—Bull. 224 :—The Production of the Lima Bean; the Need and Possibility of its Improvement. (199–246 pp.) Sacramento, 1911. [63.32.]

Horticulture—

Douglas, J.—The Carnation: Its History, Propagation, and General Culture. (20 pp.) [One and All Garden Books, No. 39.] London: Agricultural and Horticultural Association, n.d. 1*d.* [63.52.]

Oklahoma Agricultural Experiment Station.—Bull. 95 :—Varieties of Fruits raised in Oklahoma. (48 pp.) Stillwater, Oklahoma, 1911. [63.41(73).]

Nevada Agricultural Experiment Station.—Bull. 79 :—The Avoidance and Prevention of Frost in the Fruit Belts of Nevada. (58 pp. + 16 plates.) Reno, Nevada, 1912. [63.21; 63.42.]

Special Autumn Packing Edition (Volume VI., No. 3) of *Better Fruit.* (100 pp.) Hood River, Oregon: Better Fruit Publishing Co., 1911. [63.41–198.]

Maryland Agricultural Experiment Station.—Bull. 158 :—Miscellaneous Greenhouse Experiments. (97–110 pp.) [63.5–19.] Bull. 159 :—Peach Culture (111–192 pp.) [63.41(*b*).] Bull. 160 :—Strawberries. (193–220 pp.) [63.41(*c*).] College Park, Maryland, 1911.

Plant Diseases—

Ross, Dr. H.—Die Pflanzengallen (Cecidien) Mittel- und Nordeuropas; ihre Erreger und Biologie und Bestimmungstabellen. (350 pp. + x. plates.) Jena: Gustav Fischer, 1911. 9 M. [63.22.]

Kaiserliche Biologische Anstalt für Land- und Forstwirtschaft.—Flugblatt No. 51 :—Blattläuse. (4 pp.) Berlin: Paul Parey, 1912. [63.27.]

Molisch, Dr. H.—Das Erfrieren der Pflanzen. (36 pp) Vienna: Verein zur Verbreitung naturwissenschaftlicher Kenntnisse, 1911. [63.21.]

Suriname, Departement van den Landbouw.—Bull. 26 :—De Surinaamsche Panamaziekte (*Leptospora musae*) in de Gros Michel bacoven. (41 pp. + xi. plates.) Paramaribo, 1912. [63.24.]

Ontario Dept. of Agriculture.—Bull. 185 :—Little Peach Disease. (8 pp.) [63.24–41.] Bull. 187 :—The Codling Moth (*Carpocapsa pomonella*). (40 pp.) [63.27.] Toronto, 1911.

Finland, Landtbruksstyrelsens Meddelanden.—No. LXXVIII. :—Berättelse öfver Skadeinsekters Uppträdande i Finland år 1909. (29 pp.) Helsingfors, 1911. [63.292(47).]

Eriksson, Dr. J.—Über *Exosporium Ulmi*, n.sp., als Erreger von Zweigbrand an jungen Ulmenpflanzen. (35–42 pp. and plate.) [Abdruck aus Mycologisches Centralblatt, Erster Band, 1912.] [63.24.]

Oklahoma Agricultural Experiment Station.—Bull. 92:—Spray Calendar. (16 pp.) Stillwater, Oklahoma, 1911. [63.294.]

California Agricultural Experiment Station.—Bull. 226:—The Purple Scale (*Lepidosaphes beckii*). (317–340 pp.) Sacramento, 1911. [63.24.]

Maryland Agricultural Experiment Station.—Bull. 156:—Rose Mildew. (73–80 pp.) 1911. [63.24–52.] Bull. 161:—Treatment for the San José Scale and Terrapin Scale Insects. (221–234 pp.) 1911. [63.27.] Bull. 164:—Lime-Sulphur as a Summer Spray. (263–272 pp.) 1912. [63.295.] College Park, Maryland.

Kentucky Agricultural Experiment Station.—Bull. 159:—A Preliminary Study of Kentucky Localities in which Pellagra is prevalent, having reference to the Condition of the Corn Crop and to the possible presence of an Insect or other agent by which the Disease spreads. (80 pp.) Lexington, Kentucky, 1912. [59.169; 63.24–31.]

Live Stock—

Deutsche Landwirtschafts-Gesellschaft.—Flugschriften. Heft 10:—Melasse, Futterkalk und Salz. (32 pp.) 1911. [63.604(*a*).] Heft 12:—Futterfibel. (118 pp.) [63.604.] 1912. Berlin.

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Circ. 185:—State and Municipal Meat Inspection and Municipal Slaughterhouses. (241–254 pp.) [614.31.] Circ. 192:—The Regional Lymph Glands of Food-Producing Animals. (371–400 pp.) [612; 614.31.] Washington, 1912.

Deutsche Landwirtschafts-Gesellschaft.—Arbeiten. Heft 205:—Messungen an 1,460 Zuchtpferden und 590 Soldatenpferden. (247 pp.) [63.61.] Heft 206:—Die Bedeutung des Rindes für die Fleischerzeugung. (269 pp.) [63.62; 63.751.] Berlin: Paul Parey, 1912.

Wisconsin Agricultural Experiment Station.—Research Bull. 21:—Studies of the Nutrition of the Pig. (53–86 pp.) Madison, Wisconsin, 1912. [612.394; 63.64.]

Harper, M. W.—Manual of Farm Animals: A Practical Guide to the Choosing, Breeding, and Keep of Horses, Cattle, Sheep, and Swine. (545 pp.) New York: The Macmillan Co., 1911. 8*s*. 6*d*. net. [63.6(02).]

Dairying and Food, General—

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Circ. 188:—Increasing Creamery Profits by Handling Special Products and Utilising By-Products. (297–306 pp.) [63.727.] Circ. 189:—The Temperature of Pasteurisation for Butter Making. (307–326 pp.) [63.717; 63.72.] Washington, 1912.

University of Leeds.—Bull. 84:—Variation in the Composition of Cows' Milk with Advance of Lactation. (14 pp.) Leeds, 1912. [63.712.]

South Dakota Agricultural Experiment Station.—Bull. 132:—Effects of Alkali Water on Dairy Products. (218–254 pp.) Brookings, South Dakota, 1912. [63.711(*a*).]

Veterinary Science—

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Circ. 187:—Progress and Prospects of Tick Eradication. (255–265 pp.) [59.169(*b*).] Circ. 190:—The Vaccination of Cattle against Tuberculosis. (327–343 pp.) [614.5.] Circ. 198:—The Bacterium of Contagious Abortion of Cattle Demonstrated to Occur in Milk. (3 pp.) [619.2(*a*).] Washington, 1912.

Oklahoma Agricultural Experiment Station.—Bull. 96:—The Vitality of Reproductive Cells. (47 pp.) Stillwater, Oklahoma, 1911. [612.]

Nevada Agricultural Experiment Station.—Circ. 13:—Anthrax. (11 pp.) Reno, Nevada, 1911. [619.2(*b*).]

Local Government Board.—Reports on Public Health and Medical Subjects, New Series. No. 66:—Further Reports (No. 5) on Flies as Carriers of Infection. (22 pp.) London: Wyman & Sons, 1912. 3*d.* [59.169.]

Kentucky Agricultural Experiment Station.—Bull. 157:—The Dipping of Sheep for Scabies in Tobacco Dips with and without the addition of Flowers of Sulphur. (181–193 pp.) 1911. [619.3(*a*).] Bull. 160:—Parturient Paresis (Milk Fever) and Eclampsia; and the Internal Secretion of the Mammæ as a Factor in the Onset of Labour. (81–104 pp. + 18 plates.) 1912. [619.2.] Lexington, Kentucky.

Birds, Poultry, and Bees—

Ziegler, Dr. H. E. (edit.).—Zoologisches Wörterbuch: Erklärung der zoologischen Fachausdrücke. Erste Lieferung, 1911. (208 pp.) Zweite Lieferung, 1912. (209–480 pp.) Jena: Gustav Fischer. [59(02).]

Oregon Agricultural Experiment Station.—Circ. 19:—Oregon Station Trap-Nest. (4 pp.) Corvallis, Oregon, 1912. [63.6 : 69.]

Ontario Dept. of Agriculture.—Bull. 182:—Bee-Keeping in Ontario. (7 pp.) [63.81(04).] Bull. 190:—Bee Diseases in Ontario. (11 pp.) [63.81.09.] Toronto, 1911.

Maryland Agricultural Experiment Station.—Bull. 157:—Some Experiments with Poultry. (81–96 pp.) College Park, Maryland, 1911. [63.651.]

Forestry—

Kansas Agricultural Experiment Station.—Circ. 20:—The Hardy Catalpa. (19 pp.) Manhattan, Kansas, n.d. [63.491.]

Indian Forest Records.—Vol. III., Part 2:—Note on the Antiseptic Treatment of Timber in India, with Special Reference to Railway Sleepers. (107 pp. + ix. plates.) Calcutta, 1912. 1*s.* 3*d.* [63.49–198.]

Maryland Agricultural Experiment Station.—Bull. 163:—Increasing the Durability of Fence Posts. (243–262 pp.) College Park, Maryland, 1912. [63.49–198.]

Yale University Forest School.—Bull. 1:—A Classification for Forestry Literature. (6 pp.) Yale University Press, New Haven, 1912. [02; 63.49(04).]

Engineering—

Dickson, H. N.—Climate and Weather. (256 pp.) London: Williams & Norgate, n.d. 2*s.* 6*d.* net. [551.5.]

Deutsche Landwirtschafts-Gesellschaft.—Arbeiten. Heft 199:—Hauptprüfung der Untergrundlockerer; Hauptprüfung der Entkrautungsgeräte für Fischgewässer; Vorprüfung neuer Geräte Hamburg, 1911; Einzelprüfungen. (80 pp.) 1911. [63.17.] Heft 201:—Hauptprüfung der Rebkulturgeräte. (120 pp.) [63.17; 63.46.] Berlin: Paul Parey, 1912.

Oklahoma Agricultural Experiment Station.—Circ. 15:—Some Types of Silos and Equipment. (15 pp.) Stillwater, Oklahoma, 1911. [69.]

Shutt, F. T.—The Farm Water Supply. (4 pp.) [Reprinted from "The Public Health Journal, State Medicine and Sanitary Review," April, 1912.] [628.7.]

Economics—

Nicholson, E.—Men and Measures: A History of Weights and Measures Ancient and Modern. (313 pp.) London: Smith, Elder & Co., 1912. 7*s.* 6*d.* net. [389.]

Ontario Dept. of Agriculture.—Bull. 192:—Agricultural Co-operation. (52 pp.) Toronto, 1911. [334(71); 334(04).]

Spencer, A. J.—The Agricultural Holdings Act, 1908. [Fifth edition.] (179 pp.) London: Stevens & Sons, 1911. [347(*a*).]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P. 10—9. 6,000. 7/12. R. C. & S., Ltd.

THE JOURNAL

OF THE

BOARD OF AGRICULTURE

Vol. XIX. No. 5.

AUGUST, 1912.

IMPROVEMENT OF POOR HILL PASTURE.

AT the present time there are few agricultural problems of such great national importance, or so likely to repay investigation, as the question of the more effective utilisation of the poor hill pasture which forms such a large proportion of the total area of this country. Within recent years a good deal of attention has been paid to the improvement of poor lowland pasture, and it may be said that the question is now so well understood that those possessing the necessary experience and judgment are able, by careful inspection of such ground, to suggest methods of improvement which, in the great majority of cases, will be found successful, and in many instances highly profitable.*

In the case of hill pasture there are few who would be bold enough, except in a few obvious cases, to suggest methods of improvement unless in a very tentative way, and still fewer who would be prepared to give an opinion as to whether these measures, even if successful in improving the pastures, would be likely to be profitable. The question is complicated by the facts that (1) the cost of improvement is often relatively great, owing to the inaccessibility of the grazing; (2) in many cases climatic conditions restrict not only the growth of herbage, but also the grazing season, to such an extent that the value of even the greatest possible improvement is small when expressed not in percentages but in shillings per acre; (3) there are many very distinct types of herbage—or modes of growth of the same herbage—dependent doubtless on soil, climate, and general conditions, in ways not at all well understood.

---

* "Influence on the Production of Mutton of Manures applied to Pasture," *Supplement to Journal*, Jan., 1911, price 4*d*., post free.

In many cases the first great cost of improvement compared with its prospective value renders treatment quite out of the question under present economic conditions. At the same time, there are large areas of fairly accessible poor hill pasture, mostly perhaps between five hundred and one thousand feet above sea-level, which are not productive to the extent that climatic and general conditions justify one in expecting, or to the extent that they used to be within quite recent times. A considerable proportion of such land has been cultivated at one time, and in most cases it has only gone completely out of cultivation within the last fifty years or so. As already indicated, it cannot be said that much really scientific investigation has been carried out, and since the time when the old method of treatment, draining and liming, became too expensive, little attention has been paid to the subject. It is hoped, therefore, that a brief consideration of a few points on which information is available may be helpful, and stimulate further inquiry.

In considering the question of improvement, thoughts naturally turn at once to manuring. There are, however, other problems which in many cases are even more important, and a few of these may be mentioned first.

Effect of Grazing only with Sheep.—There is little doubt that continuous grazing with sheep alone will ultimately spoil almost any pastures except those on soils such as chalk or mountain-limestone, which naturally grow little but close fine herbage. The habit of sheep in closely grazing only the finest plants and in leaving the coarse plants untouched, results sooner or later in the disappearance or suppression of the former and the preponderance of coarse, inferior grasses. This effect is intensified by the fact that, if sheep are to be kept on the same ground year after year, overstocking must at all costs be avoided if a healthy flock is to be maintained, with the result that a good pasture may be never really closely grazed except perhaps at a few favoured spots.

In many cases it would pay well to mix a few cattle with the sheep on *rough* hill pasture, even though the cattle gave no return themselves for their grazing, which would seldom be the case. It is generally thought that many hill grazings in Scotland date their degeneracy from the clearance of the

Highland cattle to make way for sheep, and perhaps it is not too much to say that in all pastures, whether hill or lowland, proper grazing is at least as important as manure.

*Bracken in Pasture.**—Many pastures owe their inferiority to the presence of bracken, which in some cases has obtained such a strong hold on the ground that the pasture, as such, is worthless. Whatever the cause may be, and very often bracken has only become a serious pest since the stocking of the pasture entirely with sheep, there is no doubt as to the method to be adopted to get rid of it, viz., repeated cutting of the young shoots as they come up. The first cutting should usually be carried out some time in June, and the operation should be repeated as soon as the new leaves begin to open on the next growth of shoots. Three or four cuttings may be required in the first season, and two or three each in the following two, three, or four years. It may also be mentioned that bracken is seldom or never found in soils containing a fair quantity of lime, but whether it is possible to exterminate well-established bracken by an application of lime, in a reasonable time, is a point on which information is lacking. Probably, however, an application of lime given when possible before or during the period in which cutting is going on, would slightly lessen the number of cuttings required, and prevent the subsequent reappearance of the pest.

The necessity for constant and repeated cuttings (neglect in any one year would largely destroy the effect of previous years' work) may appear to make the method of eradication tedious and expensive. The total cost, however, in two known cases was only 14*s*. and 19*s*. an acre respectively. This is not excessive when it is remembered that the improvement, with a little care and attention in future, will be permanent, and that bracken seldom troubles the highest and poorest parts of a real hill grazing, but is found on the best of the lowest slopes, usually where the soil is good, deep, and well drained—just those areas which as part of a mountain grazing have a value greater than their intrinsic one, owing to their affording pasturage for stock at seasons when the high hills are bare of food.

---

* "The Destruction of Bracken," *Journal*, Oct., 1911, p. 568.

*Encroachment of Heather.**—On poor, dry soils, containing little or no lime, in a moderately dry climate, heather is almost certain sooner or later to creep into a pasture, and if not checked will, of course, cause serious deterioration, even though it has a certain value itself as food for sheep. Apparently little has been done to determine the best means of replacing heather by grass, *i.e.*, short of ploughing up, or of stocking more heavily than is practicable in most cases. Very often when the heather has been eradicated, either accidentally or intentionally, it has only been replaced by the much worse weed, bracken. Generally, slow and thorough burning in large areas (so as to minimise the risk of re-seeding of the burnt ground from old heather), followed by lime and superphosphate and kainit on dry soils, and basic slag with or without kainit on wetter ground, would seem the most hopeful method. As in the case of bracken, heather never appears on soils containing a fair proportion of lime. Occasionally it is found in fairly extensive tracts in mountain limestone districts, but in such cases close investigation will reveal either a "pocket" of some other rock or a bed of peat which had formed previous to the appearance of the heather, or the fact that the surface soil contains little lime in spite of its overlying the calcareous rock.

Gorse or Whins.—It is not often that gorse is regarded as a serious pest on real hill pasture, as the small amount usually found provides useful food in the hardest weather, and sheep will, if given a chance, keep it down well enough. If it has become too strong, cutting or burning destroys the old bushes, and gives young shoots and seedlings a chance, providing good food for sheep.

Moss (or "Fog") in Pasture.—As a general rule, the presence of moss in pasture is associated with either poverty of soil, deficient drainage, or lack of lime, and in such cases attention to the predisposing condition will result in more vigorous growth of grass, followed by disappearance of the weed. Very often moss is only noticed during winter when the pasture is bare, and as soon as the grass begins to grow in spring it is suppressed.

---

* An article on the Burning of Heather, with particular reference to Grouse Moors—a subject outside the scope of the present note—appeared in the Journal for Oct., 1911.

In some cases heavy rolling has resulted in clearance of moss, and it may be mentioned that in some unexplained way superphosphate has a directly destructive effect on it. Generally speaking, however, attention should be paid directly to strengthening and improving the grass, and the moss will automatically disappear.

Effect of a Dense "Sod."—In hill soils originally fairly good, but containing little or no lime, particularly if grazed with sheep alone, it commonly happens that a very dense growth of bent grass is found. The dead roots, stems, and leaves of this in such circumstances decay extremely slowly, and ultimately form a spongy layer or sod, which becomes almost peaty in character and may be several inches in thickness. In a dry climate this layer, by retaining all or most of the water falling on the area, may prevent the growth of practically all vegetation, and furthermore, may make manuring of any kind practically useless. In one such case occurring in East Lothian it was found in autumn that after three weeks of almost continuous and heavy rain the soil beneath the sod was perfectly dry and dusty. In this case, except for superphosphate, which killed the moss previously abundant on the surface, no manure had any effect, probably, or almost certainly, because it did not reach the soil for which it was intended. The only method effecting any improvement was that of facilitating the flow of water into the soil by ploughing shallow furrows at intervals of four or five feet across the face of the hill. In bad cases such a plan, possibly followed by applications of lime and basic slag, would certainly seem worthy of a trial.

MANURES FOR HILL PASTURES.

As already suggested, the old standard method of improvement was liming, preceded where necessary by draining. The latter is, of course, as essential as ever as a preliminary to further improvement, though there are parts of many hill grazings which are worth more in their undrained condition for the sake of affording pasturage at particular seasons, than they would ever be if drained and improved in any practical way. With more expensive labour and coal, and the fact that so many of the old lime-kilns have, through long neglect, become unfit for use, it is doubtful if the value of the beneficial effect, which lime undoubtedly has on old grass of all kinds, would cover the cost of the material and of the labour involved in applying it, unless in very limited quantities. Furthermore, while lime may be all that is needed in some cases, in the great majority where improvement can be effected through the soil, it is not only lime that is wanted, but also readily available phosphates. If these are given along with the lime, the cost of both may be well repaid; the use of either, separately, is, to say the least, risky. A consideration of results obtained in the experiments conducted by the Highland and Agricultural Society of Scotland leads to the conclusion that, if it is sought to effect an improvement in ordinary poor hill pastures by manuring, the first thing to be tried is the treatment of an acre or two with basic slag at the rate of, say, 8 or 10 cwt. per acre. If this is not effective, or if the improvement effected does not appear sufficiently great to repay the outlay in the course of a reasonable period, improvement should be attempted by some system other than mere manuring. It should, however, be pointed out that the improvement is often a permanent one, or at any rate one lasting for many years, so that, even though only a fraction of the original outlay is recovered in the first or second years, the operation may prove highly remunerative in the long run.

It should be unnecessary to point out that even in the case of ordinary soils, and still more in hill soils, the supply of plant food in the soil is only one of the factors that determine its fertility. If the pasture is poor because it is badly drained or because it is insufficiently supplied with moisture for the greater part of the year, no system of manuring alone will make good the deficiency. Neither slag nor any other manure can take the place of a drain or increase the depth of the soil.

In certain cases, where slag has failed to effect an improvement in a reasonable time, it is possible to suggest the cause. One which is probably fairly common is the closeness and coarseness of the herbage present—in most cases practically pure *Agrostis* (bent grass). Basic slag is principally effective as a manure for pasture because it encourages the development of the small plants of white clover or other leguminous herbage, which are usually present to some extent even in the poorest grass, and which if so encouraged, develop, often to an amazing degree. This great development is, however, only likely to take place in a pasture open, and to a great extent bare and patchy. Where the pasture to begin with is not open, but, on the contrary, is absolutely crowded with strong bent grass, the clover cannot develop, and the slag is more or less wasted. Its action is still further nullified by the thick layer or sod of slowly decaying roots, stems, and leaves usually found below such grass, which prevents the manure reaching the soil and the roots, for which it is intended, for some considerable time.

In such a case, either close grazing with cattle or actual ploughing up, and the application of lime in addition to basic slag, must be adopted if satisfactory improvement is to be brought about. Usually soils on which this type of herbage occurs are naturally fairly good, and capable of giving good returns if properly treated, so that the cost of the methods suggested is not incommensurate with the results likely to be obtained.

While here, and in previous instances, ploughing up poor pasture has been referred to, it may perhaps be taken as a general rule that it is inadvisable to plough up any extent of the kind of land under consideration, unless it is certain that less drastic measures are of no use, and, further, that it will be possible to form a good pasture after the land has been cultivated to a certain extent. As a rule, this will not be difficult in a moist climate or even in a comparatively dry one if the soil is fairly retentive and, above all, if it contains a considerable quantity of decaying vegetable matter.

In many cases failure to form even a moderately good pasture on ploughed-up hill land has been due to the fact that it has been kept under the plough too long, with the result that the old stock of organic matter, on which the fertility of such soil so very largely depends, has been unduly depleted. There are many cases where ploughing up and re-formation of pasture has been attended with highly profitable results.

CONFERENCE OF AGRICULTURAL TEACHERS AT CAMBRIDGE.

A Conference of Agricultural Teachers, organised by the Cambridge University Department of Agriculture and supported by the Board of Agriculture and Fisheries, met at Cambridge on the 18th July.

Conferences of this nature are frequently held in America, but the Cambridge Conference is the first held in this country. The object in view is to bring teachers of agriculture into touch with the latest developments of the sciences bearing on agriculture, through the medium of lectures and demonstrations delivered by recognised experts in the several branches of agricultural knowledge. Cambridge is particularly well suited for the purpose of a Conference of this sort, more especially when, as in this instance, one of the Colleges (St. Catharine's) is good enough to place its rooms at the service of the members of the Conference. The Conference was attended by upwards of thirty agricultural teachers and others interested in agricultural education. The following is a summary of the proceedings:—

FRIDAY, 19TH JULY.

Improvement of Cereals.

The Conference opened with a paper by Prof. T. B. Wood on "Quality in Wheat," in which he gave the results of some of his researches in the chemistry of bread-making. It was shown that high-class bread cannot be baked from ordinary English flours, and that we are dependent for our best bread on the "strong" flours obtained from foreign wheats. There appears to be good reason for believing that "strength" of flour is definitely correlated with the amount of soluble phosphates in the grain, and that wheats such as "Manitoba Hard" are characterised by a higher percentage of soluble phosphates than is found in ordinary English wheats, such as "Square Head's Master." "Strong" flours also have the capacity of producing a relatively larger amount of carbonic acid gas than "weak" flours, and the result of this double superiority is that these flours produce a larger, better coloured, and more shapely loaf than do "weak" flours.

Prof. Wood demonstrated the use of an apparatus he has devised for making rapid determinations of the comparative strength of samples of flour, with a view to aid the plant-breeder in selecting new types of wheat.

Prof. J. Percival read a paper describing the work on which he is engaged at Reading in connection with the improvement of wheat by selection. Samples of wheat from all over the world have been obtained and grown under standard conditions, and selections of some promising types have been made. A wheat has recently been introduced by Prof. Percival under the name of "Blue Cone." It is a wheat of the Rivett type, and is described as a heavy cropper, with the further merits of being practically immune to rust and not being liable to the attacks of sparrows. It has been found extremely difficult to carry out tests with varieties of cereals, and it was suggested that the ordinary single plots are of very little use as a real test. Various methods had been tried, and the effect of such disturbing factors as the outside of the plots determined. It was found with cereals that the effect of the outside disappeared about 4 ft. from the edge of the plot. Prof. Percival is of opinion that cropping capacity rather than quality is the desideratum in the search for improved varieties of wheat, a view which was vigorously opposed by some members of the Conference.

Mr. E. S. Beaven gave an interesting account of the researches on barley which he has carried on at Warminster for many years. He described the method he has devised for the comparative testing of varieties of barley, which is briefly the growing of a large number of small plots arranged chess-board fashion, and in such a way that it is possible to reduce the error due to environmental differences to extremely small proportions. Mr. Beaven is of opinion that, for most parts of the kingdom, Archer barley is the most suitable. In regard to cropping capacity, Mr. Beaven communicated a noteworthy discovery. It appears that (*ceteris paribus*) yield is largely dependent on the nitrogen content of the mother-seed, and it would seem to follow that if the maximum out-turn of barley is required, seed with a large flinty grain should be selected, or grown by suitable treatment. The lecturer considers that, so far as any one variety is concerned, malting quality is solely a question of the method of growth, a [illegible] he fact that the seed is not a good "malting sample" has no necessary effect on the grain of the resulting harvest, provided the crop is grown under conditions suitable for the production of a good malting barley. Mr. Beaven also drew attention to the marked differences in the degree of translocation of nitrogen from the straw to the seed in cereals grown under different seasonal or manurial conditions, and illustrated this point with an interesting series of figures derived from the Rothamsted Memoirs.

Mr. A. B. Bruce gave an account of researches carried out in the School of Agriculture, Cambridge, on material provided by Mr. Beaven—with a view to ascertain whether the heredity of certain quantitative characters in barley is governed by the Mendelian law. The results so far are negative.

In the discussion which followed, many interesting points in connection with the growth of cereals were debated. Prof. Percival expressed the opinion that it is impossible to combine maximum yield with maximum quality, but admitted that there is no reason to deprecate an attempt to improve the quality while maintaining yield at existing standards.

SATURDAY, 20TH JULY.

Quality in Wheat.

Prof. R. H. Biffen read a paper on "Quality in Wheat," and described what has been done by the Home Grown Wheat Committee in connection with this subject. It was pointed out that the appearance in the British market of the Canadian wheat "Manitoba Hard," and the improvements in milling processes have set up a new standard of quality for baking purposes. Rating the best Canadian wheat at 100, a good average flour wheat now in general demand for breadmaking might be reckoned at 80, while to ordinary home-grown wheat the highest figure that could be assigned was 60. As a consequence, the British miller was forced to use a large admixture of foreign wheat, otherwise his flour was unsaleable. Prof. Biffen stated that "strong" foreign wheat may be worth to the inland miller as much as ten shillings per quarter more than home grown. The Home Grown Wheat

Committee have conducted a long series of experiments with the object of discovering what steps should be taken to produce strong wheats in this country. It has been shown that neither soils nor manures are capable of raising the baking quality of ordinary British wheat above 70, and that improvement must be sought in the introduction of new varieties. Wheats from all parts of the world have been tested, with the remarkable result that only one wheat (of the varieties in general use), namely, Red Fife, has been found to retain its strength under all conditions of soil and treatment. Unfortunately, in most parts of the country this variety is such a poor cropper that it is quite unsuitable for introduction. Prof. Biffen went on to describe the results of his breeding operations, which have been successfully directed to transferring the valuable qualities of Red Fife to British varieties. A wheat known as Burgoyne's Fife has been produced, which has all the external characteristics of the variety known as Essex Rough Chaff, with the added advantage that the grain, instead of being weak like that of one parent, is nearly as strong as that of the other parent, Red Fife. Moreover, from the results of a number of trials on the field scale carried out last year, it can be confidently asserted that in cropping capacity Burgoyne's Fife is equal to the average of standard British wheats.

In the afternoon a visit was paid to the University Field Laboratories, where demonstrations were given in experiments on animal nutrition by Dr. F. Hopkins and others.

Parasitology.

Subsequently the Conference attended a lecture by Dr. Nuttall on "Parasitology," as illustrated by the etiology and treatment of Red-water Fever. It appears that this disease exists in two forms—one, the more deadly, being carried from one animal to another by the tick *Boophilus*, and the other, a much milder form, being transmitted by the tick *Ixodes ricinus*. The former is parasitic on one host through all stages of its life-cycle, but the latter may resort to four different hosts in its cycle, and is consequently less amenable to attack by tick-preventive measures. It was shown that "salting"—that is, the immunisation of young stock by inoculation, whether naturally or artificially induced, is open to the objection that the blood of the salted animals remains infective. An account was given of the remarkable curative properties in relation to this disease of "Trypan Blue," the use of which was introduced by the lecturer.

In the evening a lecture on "The Origin of the Domestic Sheep" was given by Prof. Cossar Ewart. The domestic sheep is the only one having a long tail, and on this account it has generally been assumed that it is descended from a wild breed of sheep which has long been extinct. Professor Ewart, however, believes that it is not necessary to assume this, and suggests that the ancestors of our modern domesticated sheep might quite well have resembled some of the wild sheep now existent. In support of his view, he described sheep of practically the Mouflon or Ural type, which he had found in small numbers in the islands of Soay, Fair Isle, and North Ronaldshay. These are characterised by simply curved horns, short tails, and extremely fine wool, which is practically equal in value to that of the Merino. He concludes that these sheep represent survivals of the first sheep reaching this country or Western Europe from Asia and Eastern Europe. Experiments are being carried out in breeding from the Soay sheep with a view to combining their fineness of wool with the points and characteristics desired by the butcher.

MONDAY, 22ND JULY.

Mendelism and the Inheritance of Distinct Characters.

In the forenoon Dr. Salaman lectured on the subject of his researches on potato breeding. He has succeeded in establishing that the inheritance of many characters in the potato is governed by the Mendelian law. Practically, all domestic varieties are hybrid in the Mendelian sense—that is, if the flowers are selfed and plants are raised from the true seed (as distinct from the tuber), a large number of types differing from the parent are produced. Dr. Salaman showed that in regard to shape of tuber (long or round), habit of growth (erect or procumbent), colour of tuber (red, purple, or white), the inheritance follows the Mendelian law of segregation. Interesting results have been obtained from a study of the wild species *Solanum etuberosum,* which, though grown in this country for many years previously, set seed for the first time in 1906. The interest of this variety lies in the fact that it is believed to be immune to *Phytophthora* disease, and there is consequently a possibility that by working on Mendelian lines it may be practicable to produce a variety of the domestic potato immune to this disease.

In the afternoon a visit was paid to the University Farm, where demonstrations on the new varieties of barley growing there were given by Mr. E. S. Beaven. Dr. Salaman also demonstrated the results of his work on potatoes.

In the evening a lecture was given by Prof. Punnett on some new results which he has obtained in regard to the inheritance of coat colour in rabbits. He was able to show that some difficulties in applying the Mendelian law to this problem could be solved on the supposition of association, or coupling of the Mendelian factors concerned.

TUESDAY, 23RD JULY.

Animal Nutrition.

In the forenoon Dr. Hopkins lectured on some new developments in the physiology of animal nutrition. He showed that there is grave reason to doubt accepted theories (associated with the work of Rubner and Kellner) based on the assumption that the nutritive value of different foodstuffs can be expressed in terms of their energy value. In his view, what may be termed the specificity of composition of a diet is of more importance than its aggregate energy value as measured by the "starch equivalent." His experiments with zein (the alcohol-extracted protein of maize) showed that this substance by itself is insufficient to maintain life, but that if the amino-acid tryptophane—a constituent of most proteins, but absent in zein—be added to the diet, normal conditions of maintenance and growth are restored. At the same time, the lecturer was of opinion that too great stress should not be laid on the specificity of a diet from the point of view of the amino-acids present, and instanced the fact that the animal has the power in some cases of synthetising the amino-acid that its economy requires—a power, however, that seems to be limited to the "chain" compounds, and does not extend to the building up of the "ring" class of organic substances. Dr. Hopkins went on to give an account of a most interesting fact that he discovered as long ago as 1907, namely, that there is present in milk (in quantities of less than 0·1 per cent.), and probably in all organic tissues, some substance which is essential to growth, a substance which is not a protein, which may be of the nature of a catalyst or enzyme, but which he has not yet succeeded in isolating. Facts of this nature, therefore, point to the necessity of further investigations with a view to reconstruct the theory of animal nutrition on a new basis.

In the subsequent discussion Mr. W. Bruce contributed some interesting results which he had obtained from a feeding experiment with cattle, and which showed that rations of the same nutritive value in terms of the starch equivalents gave very different results in practice.

The Relation of Weather to Agriculture.

In the afternoon, Dr. W. N. Shaw, Director of the Meteorological Office, read a paper on the bearings of his work on agriculture. He estimated that the losses due to "tempests" (that is, unfavourable weather conditions) are at least twenty million pounds annually, and that if even a small fraction of that loss could be prevented by the intelligent use of forecasts of the weather, the gain to the country at large would be immense. He instanced the prediction of frosts by the Weather Bureau of the United States as an example of the benefits that have accrued to agriculture from the science of meteorology. As a demonstration of the efficiency of the system of weather reporting, he presented the meeting with the daily weather report which had been compiled from observations made at 7 a.m. the same morning at some hundreds of stations, including the Azores and Iceland, the British Isles, and the West of Europe. In relation to the use of the statistics of weather that have been collected by the Meteorological Office, the lecturer pointed out that in regard to their application to agriculture, a serious difficulty arose from the fact that good weather in this connection is difficult to define. A number of diagrams were shown to illustrate the connection between crop production and such meteorological conditions as temperature, sunshine, and rainfall. The intimate connection between the weather prevailing in one autumn and the yield of the following year was strikingly illustrated by these charts. It appears that the yield of wheat depends to a great extent on the amount of the previous autumn's rainfall. Further, there appears to be a cycle of eleven years with regard to average wheat yield.

Statistics and Results of Experiments.

The day closed with a lecture by Mr. G. Udny Yule on the need for the application of statistical methods to the interpretation of experimental results. The lecturer illustrated this need by considering the question of the precautions that should be taken to lessen the experimental error in connection with field trials. He dwelt on the extreme untrustworthiness of the results obtained from single-field plots in such experiments, and advocated the adoption of a system whereby a number of small scattered plots should be substituted for large single or duplicate plots. Similarly, in regard to feeding experiments with animals, he pointed out that there is an even chance that the figures relating to any one animal may vary as much as 14 per cent. either above or below the true value, and that, consequently, the number of animals that should be used in a particular experiment should be increased until the margin of error of the average falls well below the differences which the experiment was designed to investigate. He deprecated the distrust with which scientific men often viewed statistical methods, and suggested that it was largely due to an unfounded belief that advocacy of the need for the statistical interpretation of experimental results conveyed an imputation against the trustworthiness of the experimental methods adopted. There must always be a cloud of uncontrollable circumstances affecting the validity of the conclusions to be drawn from experimental results, and it was the business of the statistician to elaborate methods by which the weight to be attached to results might be accurately estimated and appraised.

WEDNESDAY, 24TH JULY.

The Soil Solution and the Nutrition of Plants.

In the morning Mr. Hall commenced his paper on "The Soil Solution and the Nutrition of the Plant."

Theories as to soil solution have been enunciated by Whitney and Cameron in the United States. Regarding the matter from the physical chemist's standpoint, they assume that the solution in an ordinary soil is saturated with regard to any mineral ingredient, and, therefore, of fixed strength, as, *e.g.*, if 0·1 per cent. of phosphate in a soil is sufficient to give a saturated solution, the solution cannot be made stronger by adding phosphate until 0·5 per cent. of phosphate be present, for any excess over the concentration of equilibrium becomes insoluble. They also say that, regarding the substances merely as nutrients, it is immaterial to the plant how much phosphate or potash is added to the soil, as in practice there is always sufficient to make a saturated solution. If this theory be accepted it is necessary to find some explanation of the value of manuring and of rotations, and the one suggested is that plant roots excrete toxic substances, and that manures neutralise these, and so enable plants to grow satisfactorily. In a similar way a rotation is said to be of benefit because the toxins from one plant are not necessarily toxic to plants of another kind.

As these theories run counter to the views usually accepted, and as little exact information as to the experiments on which they are presumably based is available, investigations were commenced at Rothamsted to clear up the whole subject. The soils of some of the plots continuously cropped with wheat and barley were extracted with water to obtain what might be taken as corresponding to the soil solution. The extracts were analysed and plants were grown in them. It was found that the composition of the extracts and the weight of dry matter obtained in the plants were in very close agreement with the system of manuring and with the crops obtained in the field.

Furthermore, there was no evidence that any toxic material had been excreted, and barley grown in the extract from the wheat soil was no more successful than wheat, and *vice* *versâ.* Buckwheat and sunflowers also showed very similar results.

Attempts were then made to repair the deficiency in extracts from the unmanured soils by adding phosphate and potash (to simplify the experiment, each plant was supplied with quite sufficient nitrogen in an available form) in quantity sufficient to bring the composition up to that from the continuously dunged plot. Except in one or two cases, these attempts were apparently unsuccessful, and, for instance, the extract from the unmanured plot gave plants which were little better for the addition of manure. This result, of course, was opposed to the conclusions drawn from the first experiment, and supports the American view. The cultures were, however, not satisfactory; difficulty is always experienced at Rothamsted in making water cultures in late summer or autumn, and the results were not regarded as conclusive. In 1912, when the experiments were repeated, attempts to level up the soil extracts artificially were successful, and it was concluded that the result of the second series of experiments might probably be regarded as abnormal.

The question was also approached in another way. It might be argued that in all cases the soil solution is very dilute, and that a little alteration in its concentration would produce little or no effect if it is renewed sufficiently quickly, and if the total amount of material in solution is sufficient to meet the requirements of the crops. To test this, plants were grown in solutions of different degrees of concentration, and also in sand watered with solutions of varying strengths. In both cases it was found that the plant growth was proportional to the degree of concentration of the solution employed, even though the total amount of material in solution supplied was much greater than the plants' requirements.

Still another point presented itself—the salts in solution are removed by the plant, and the solution has to be renewed; it is possible that the growth of the crop may be determined by the rate of diffusion from other unexploited parts of the soil. From evidence obtained from the manured grass plots at Rothamsted, it appears that lateral diffusion even of nitrate of soda in the soil is very slow. Sand cultures were, therefore, made in large pots, in which the nutrient solution was placed in an inner earthenware pot. It was found that the growth in such compared quite favourably with that in control plots, and there appeared to be no lag at all.

The research is proceeding, and it is too soon to draw definite conclusions, but up to the present, except for the second tests in the first set of experiments, no evidence has been obtained in support of the American view of the nature of soil solutions and of the action of manures.

Effect of Aeration of Soil.—A point brought out incidentally was the importance of aeration of the soil. In making sand cultures, the sand was mixed with just sufficient water to produce a nice "crumby" condition, in which it contained sufficient moisture to meet the requirements of the plant, but still was in such a dry condition as to hold no water except that held in the films round the soil particles. The growth of plants in this was out of all proportion to that in water cultures, though the usual precautions as to blowing air through the water daily were taken. When air was bubbled through continuously, growth was greatly improved, though not quite equal to that in the sand.

Attention was also drawn to the fact that the old idea that plant roots excreted an acid juice is now known to be incorrect. The only acid so excreted is carbon dioxide, which is given off in the ordinary course of respiration. Generally the amount of carbon dioxide in the soil atmosphere is only from 1 to 3 per cent., and this cannot make a solution strong enough to account for the known dissolving power of roots, but the gas just as it leaves the roots forms a much stronger solution.

Visit to the University Farm.

In the afternoon a visit was paid to the University Farm. The sheep crosses were examined, and the features of the research were demonstrated by Messrs. Mackenzie and Bailey. The work was originally suggested by Australian flockmasters, who wished the School of Agriculture to attempt to combine on Mendelian lines the fleece of the Merino with the carcass of the Shropshire, and for the purpose supplied two pure Merino rams. Mr. Mackenzie explained that the first problem attacked was the standardisation of the points of a carcass sheep and the reduction of the judging of a sheep to the making of a simple set of measurements. A scheme had been drawn up and appeared to work fairly satisfactorily, though up to the present the number of animals measured has been too small to make it possible to form definite conclusions.

Mr. Bailey demonstrated the differences between the wool of the Merino and that of the Shropshire, pointing out the fineness, closeness, uniformity, and greasiness of the former as compared with that of the latter. An examination of the first crosses showed that they partook of the nature of both Shropshire and Merino in carcass and fleece. In the lambs of the F_2 generation a certain amount of segregation was noticed, but definite conclusions cannot yet be drawn, particularly as the full characteristics of the merino fleece are not developed until the second or third year. Steps are being taken to obtain a much larger number of F_2 lambs.

Prof. Biffen then led the party through the wheat plots on the farm, and pointed out the characters of new wheats, explaining their origin and the system adopted in selection of new varieties. After a promising new type is obtained (the preliminary crossing is carried out in a cage) in sufficient quantity, a small plot is sown in the open field so as to approach as nearly to ordinary conditions of cultivation as possible. Just before harvest these plots, which this year number about 600, are carefully examined, and every wheat showing undesirable characteristics, such as weakness of straw, liability to disease, unevenness of ripening, deficient cropping power, &c., is rejected. Of the whole, about three-quarters are eliminated in this way. After harvest the number is still further reduced, and only about fifty would this year be kept for further tests. A striking feature was the fact that in each plot all the plants were quite uniform in all characters, and Prof. Biffen explained that no "rogueing" was carried out, nor required.

Grouse Disease.

In the evening Dr. A. E. Shipley lectured on Grouse Disease. Grouse disease was formerly attributed to the action of a specific organism, the *Bacillus Coli,* which is now known to be a normal occupant of animal intestines. The Committee on grouse disease ascertained that the grouse suffers from a very large number of both external and internal animal parasites, and that probably in most cases one or more of these first seriously weakens the bird or damages the tissues, enabling the *Bacillus Coli* to penetrate into the tissues and cause inflammation of the intestines, &c. Of the external parasites, mites, lice, fleas and ticks are important, and it is possible that some, particularly perhaps the flea, in addition to the direct effect, act as intermediate hosts of the tapeworms. Of the internal parasites, two tapeworms are particularly common. In addition, *Coccidiosis* attacks young birds, and strongyles take possession of the cæcum, which in the grouse is of especial importance as being the only absorptive organ.

The life history of the different parasites was described and illustrated, and the importance of proper and frequent burning of grouse moors was emphasised.

THURSDAY, 25TH JULY.

In the morning Mr. Hall continued his paper on "The Soil Solution and the Nutrition of the Plant," a summary of which has already been given.

Disease Resistance.

In the afternoon Prof. R. H. Biffen read a paper on "Disease Resistance." Little attention has been paid by either botanists or mycologists to the practical aspect of plant diseases, and the whole subject is in an unsatisfactory condition. The only advice the scientist is able to give the practical man, as a rule, is to spray with Bordeaux Mixture or other fungicides which are often costly to apply, and which may or may not be effective.

In the course of work on the breeding of wheats, it was noticed that there was great difference with regard to the susceptibility of the different varieties to rust (*Puccinia glumarum*). Michigan Bronze is in this country so susceptible that it often quite fails to form seed, while American Club is almost absolutely resistant even when grown in the worst possible conditions.

In order to ascertain whether disease resistance is inherited on definite lines, American Club and Michigan Bronze were crossed. All the F_1 plants or first crosses were highly susceptible. In the F_2 generation some plants were extremely susceptible, others equally immune, and the proportion of immune to susceptible plants was almost exactly 1 to 3. It was concluded that immunity to disease was in this case recessive, and in the case of other plant diseases immunity has also proved recessive. Immune wheats are, as a rule, poor croppers, or have other characteristics which make them undesirable, but as a result of the investigation into the inheritance of immunity, it was found possible to combine good cropping powers with immunity, and a wheat which has proved satisfactory in both respects is "Little Joss," obtained by crossing Square Head's Master with Ghirka.

Causes of Immunity.—If spores of *Puccinia* be put on to leaves of both immune and susceptible wheats, the behaviour for about the first three days is the same. The spores germinate and the mycelium penetrates the stoma (it does not pierce the cuticle, so that thickness of cuticle has nothing to do with disease resistance) and spreads through the intercellular spaces of the leaf in each case. About the third day the mycelia begin to penetrate into the cells themselves. If the wheat is susceptible, the cells are destroyed, the mycelium grows extremely rapidly, and ultimately gives rise to a fresh crop of spores. In an immune wheat the cell into which the mycelium has penetrated dies, but then the mycelium dies too. The cells of immune wheats are able to build up substances toxic to rust mycelia. To a great extent the formation of these substances depends on external conditions. If a plant is badly starved it will not readily rust, and even Michigan Bronze may be grown in such a way that it cannot be infected experimentally. If, on the other hand, excess of nitrate of soda or sulphate of ammonia be given, susceptibility is increased. Potash increases power of resistance.

House Flies.

In the evening Dr. Graham Smith lectured on "House Flies, their Habits and Relations to Disease."

Several flies are commonly found in houses, the chief being the House Fly and the Small House Fly, while the Blue Bottle, the Green Bottle, and the Flesh Flies come indoors more or less intermittently. The House Fly lays its eggs in refuse of all kinds, and undergoes the ordinary transformations of an insect. Photographs and diagrams were shown to illustrate the anatomy and physiology of flies and the differences between the different kinds.

The House Fly to a certain extent may act as a carrier of disease if it first walks over infected material and then over food, but this perhaps is the least important of the methods, as bacteria do not remain long on the legs or external parts of the insect. Much more important is the method made possible by the peculiarity of its digestion. The fly has, in addition to intestines, a crop which acts as a storehouse of food. In feeding, the crop is filled before any food passes into the intestine, but after it is filled any further supply of food is passed direct to the gut, so that material may remain in the crop for very considerable periods, and infection may be transmitted both by the vomit and by the fæces. In the case of flies fed experimentally on cultures of various pathogenic bacteria, infective power was found to be retained for periods ranging up to fourteen or sixteen days, and in the case of spore-forming organisms for considerably longer periods.

FRIDAY, 26TH JULY.

Mr. Hall concluded his paper on "The Soil Solution and the Nutrition of the Plant."

A CASE OF SOIL INFERTILITY DUE TO BAD TEXTURE AND LACK OF LIME.

J. A. HANLEY, A.R.C.S.,
Rothamsted Experimental Station.

Some of the most difficult cases on which agricultural chemists are called to give advice are those arising from differences in fertility of portions of the same field or of adjacent fields. A case in point is one which has just come to light near Luton, Bedfordshire. The soil is a loam overlying the chalk, and the field in question is situated on the top of the chalk escarpment, and extends for some distance down the dip slope.

The field can quite easily be divided into two portions by a fairly sharp line running almost along the top of the escarpment, and parallel to it.

The first portion works quite easily, and leaves an excellent tilth, whilst the second portion, although ploughing up in apparently good condition, washes or "lashes" down very badly after heavy rain. It sets quite hard, and a winter ploughing produces practically no tilth.

Both portions of the field have been treated in the same way for years, so far as their different characters would allow, so that as regards working and manuring there is nothing to account for the good crops from the first portion and the very indifferent crops from the second.

The surface soil and subsoil from each portion of the field were analysed mechanically, with the results shown in Table I.

The percentage of clay is practically the same throughout, except in the case of the subsoil of the good portion, where the highest proportion prevails.

The chief difference between the two soils occurs in the "coarse sand," "fine sand," and "silt" which together make up just over 60 per cent. of each soil. They are distributed differently, however, in the two soils, there being more sand and much less silt in the good soil. Again, there are more stones in the good soil, a fact which is also evident from the look of the field.

All these differences tend to show that the good portion will be easier to work and more open than the bad portion, but the mechanical analysis alone does not show a sufficient reason for the stiff, unfriable nature of the bad portion.

TABLE I.

MECHANICAL COMPOSITION OF AIR-DRIED SAMPLE OF LUTON SOIL.

	First 9 inches.		Second 9 inches.	
	Good Portion.	Bad Portion.	Good Portion.	Bad Portion.
	Per cent.	Per cent.	Per cent.	Per cent.
Fine Gravel above 1 mm.	1·70	1·25	1·07	2·16
Coarse Sand, 1—0·2 mm.	10·70	3·84	16·89	2·76
Fine ,, 0·2—0·04 mm. ...	21·10	19·62	26·87	16·83
Silt, 0·04—0·01 mm.	29·91	40·60	18·68	42·47
Fine Silt, 0·01—0·002 mm.... ...	11·25	13·96	12·04	13·89
Clay below 0·002 mm....	11·49	11·33	18·74	11·25
Loss on Solution in N/5 HCl ...	5·77	3·59	4·09	4·31
Loss on ignition (organic matter)	6·47	5·06	4·20	4·57
Hygroscopic Moisture	2·61	2·31	2·30	2·65
	Per cent. on Total Sample taken.			
Original Moisture	14·73	16·27	12·12	14·58
Stones above 3 mm.	15·78	7·58	15·17	10·67

Much heavier soils than this will, with due care, provide a good tilth. The Rothamsted fields are much more clayey: Barnfield contains about 22 per cent. of clay in the surface soil, and yet, with care, gives a good start every year to its mangold crop, particularly on the dunged plots.

The important difference between the two portions of the field was brought out by the estimation of calcium carbonate:—

Good Portion	Surface Soil	2·0	per cent.
	Subsoil	1·0	,,
Bad Portion	Surface Soil	0·28	,,
	Subsoil	0·28	,,

The fact that the amount of lime in the surface soil and sub-soil is the same indicates clearly that the field has received no considerable dressing of lime for many years, since it has been definitely shown at Rothamsted that, in the case of arable land, practically the whole of the added lime remains in the surface soil, except that washed out by solution.

The quantity of lime in the bad portion is quite sufficient to keep down acidity in the soil, and also to satisfy the immediate needs of crops, but is not nearly sufficient to ensure a good texture in a soil containing over 11 per cent. of clay.

In gleaning information on the past treatment of the field, the writer learnt that most of the farm was well chalked about forty years ago; there is a "dell," or old lime-pit, in the field, which also points to the same thing. This pit is almost on the line between the two portions, which gives indications of having been the line of an old fence, and hence the two portions may have been separate fields or even fields on separate farms, only one of which was chalked.

The farmer had tried a dressing of lime on alternate lands in the winter of 1909; the wheat sown that winter failed, and the field was re-sown with barley in spring, followed by winter-oats, which were harvested in 1911; neither of these crops appeared to benefit by the liming. The explanation is that the field has got into such a bad state that the whole texture of the soil must be altered before a really satisfactory crop can be obtained, and this operation naturally takes considerable time.

Too much emphasis cannot be laid on the fact that the old methods of chalking, so rarely seen now, laid the foundation of the successful cultivation of these soils.

A well-known example of the effects of omitting part of an estate when chalking is the case of Geescroft, one of the experimental fields at Rothamsted. This field became quite unworkable during a series of wet seasons in the 'seventies, and has since been allowed to run wild. The results of analyses of Geescroft are given in Table II., where it is compared with another very similar, but good arable field at Rothamsted.

TABLE II.

	Hamsey Green.		Rothamsted.	
	Arable Soil.	Too sticky for Arable.	Arable Soil. Barnfield.	Too sticky for Arable. Geescroft.
Fine Gravel	1·7	1·6	2·4	1·8
Coarse Sand	5·3	9·5	5·5	4·9
Fine ,, ...	28·7	22·3	20·3	27·8
Silt	26·3	25·4	24·4	25·4
Fine Silt...	10·2	9·9	12·7	10·6
Clay...	16·4	16·0	22·0	19·0
Loss on Ignition	4·8	5·2	4·7	5·1
Calcium Carbonate ...	1·02	0·48	3·0	0·16

A similar case is quoted in a paper by A. D. id E. J. Russell (*Journ. of Agric. Science,* Oct., 1 d, curiously enough, occurs on a similar soil, viz., clay with flints at Hamsey Green, Surrey. The results of analysis of this soil also appear in Table II., and are taken from the paper quoted above.

In these two examples the mechanical analysis points in each case to two soils practically identical as regards particles of which they are composed. The estimation of calcium carbonate brings out the reason for the stickiness in two of the soils.

HOP GROWING ON THE PACIFIC COAST OF AMERICA.

ARTHUR AMOS, M.A.,
Department of Agriculture, Cambridge University.

IV.

Picking.—Hop-picking is everywhere associated with great difficulties and anxieties, and these are in some respects intensified on the Pacific Coast. Not only is the period in which hops are at their prime a very short one, owing to the paucity of varieties and the rapidity of ripening in the hot climate, but the number of pickers is naturally limited in a country where the population is scattered. Owing to this difficulty of obtaining a sufficient number of pickers, growers have in the past gone to no little trouble and expense in making hop-picking pleasant for the pickers, some of the larger growers having provided dancing floors for their employées' use in the evening, while others have given barbiques, at which carcasses of meat are roasted whole, at the conclusion of picking. The difficulty of obtaining pickers in 1911 was, however, less serious than in past years. The introduction of the picking machine, by the E. C. Horst Company, has eased matters to a certain extent, but the chief reason why pickers are now more easily obtained is that there has been a rapid influx of population into Western States from the East.

The pickers are derived from a variety of sources; firstly from the European population of the large towns, like San Francisco and Sacramento; secondly, from the Japanese and

Chinese; thirdly, from Hindus; and lastly from among the native Indians, who, though as a general rule disinclined to work, yet engage in hop-picking in large numbers.

Among such a motley crowd strikes are very frequent, disputes arising not only as to the price to be paid for picking, but also as to whether pickers of Asiatic origin shall be allowed to work in the same gardens with Europeans.

The date at which picking commences varies with the different districts. In the hot Sacramento valley the picking usually starts before the middle of August; in Sonoma picking commences towards the end of the same month; whilst the date of picking in Oregon, Washington, and British Columbia is at the same time as the English picking, early in September.

Picking is always done by contract, the price being fixed before picking commences. In California the price is fixed at so much per 100 lb. of green hops. This method, which could not be employed in England owing to the frequency of rain, works well in the dry climate, where not only is there no rain during the picking season, but the hops almost invariably grow to a uniform size. Thus it is possible to fix a uniform price which is usually $1, or 4*s*., per 100 lb. of green hops.

In Oregon and other districts where rain is more common this method is not employed. The hops are measured instead in boxes, constructed to hold about 50 lb. of green hops. The price per box is usually $½, or 2*s*.

The Picking Machine.—The hop-picking machine, which owes its inception and development to two men, Mr. E. Clemens Horst and his able lieutenant, Mr. Eder, stands out pre-eminently amongst the hop-yard machinery as a most wonderful piece of mechanism and invention. When the idea of its construction first originated, now some six or seven years ago, very few of the actual difficulties, which have been met and surmounted, could have been realised. A factor which added greatly to the difficulty of construction was the exceedingly short period of picking in each year during which practical tests of the machine were possible, and this was accentuated by the inevitable condition of rush and hurry which is always associated with hop-picking. In spite of these difficulties a machine has been constructed which under certain conditions is capable of picking hops, and thus obviates the necessity of annually collecting gangs of pickers.

The hop-picking machine is very complicated. The several parts of the machine are operated by a chain driven from a shafting, which is in turn driven by a steam engine. Some idea of the size of the machinery may be gathered from the dimensions of its principal part, the "picker." This is approximately 75 ft. long, 12 ft. wide, and 15 ft. high. Within the compass of this article it will be impossible to describe the machine fully, but a general idea of the working of the machine may be gathered from the following account of the functions of its several parts.

The picker consists of a number of drums, 26 in all, arranged in two rows one above the other. The hop-bines are dragged slowly, first over the drums and then backwards between the two rows of them. At the same time the drums are caused to revolve in the opposite direction to that in which the bines are dragged. The drums, which are 3 ft. in diameter and 6 ft. in length, carry on their peripheries a large number of steel-wire "fingers." These fingers are bent at their centres to form an acute angle. The hops are caught in these angles or "fingers," and by the motion of the bine in one direction and the drum in the other, are severed from the bines. Unfortunately many leaves as well as large and small bunches are pulled off at the same time.

This mixture of hops, leaves and bunches have next to be separated. The first separation is that of the large bunches. After the hops have been severed from the bine, they drop upon a grating, set on a slope of about 45°. The hops, small bunches, and leaves, fall through the grating, whilst the large bunches are caught by the bars, and slide away to the side.

The mixture, now freed from the large bunches, is caused to fall upon an endless band, by which it is conveyed to a part of the machine called the "separator." This consists of a large hollow galvanised iron cylinder, which is kept constantly revolving. This cylinder, the sides of which are perforated with great numbers of holes, large enough to allow the single hops to fall through easily, is set at an angle of about 30°. The hops are delivered by the conveyor into the upper end of this cylinder, and, as the mixture rolls down inside, the hops and small leaves fall through the holes, and are thus separated from the large leaves and small bunches, which are delivered at the lower end of the cylinder.

The last separation of hops and leaves is effected by causing the hops to fall upon an endless band continually moving up an inclined plane at an angle of 45°. The hops being round or oval roll down the band, whilst the leaves being flat lie upon the band, and are carried upwards, and are thus separated from the hops. Finally, the hops are elevated and conveyed mechanically on to the kilns for drying.

Special parts of the machine are adapted for picking the bunches, after which the hops and leaves are separated in the same way as described above.

It can be readily understood that such a complicated machine requires careful supervision and attention, and thus several men are employed to attend to the mechanical parts, in addition to the staff required to cut and bring in the hops from the garden, as well as to feed the hops to the machine. In all each machine requires a complement of about sixteen men.

Each machine, when in working order, is capable of picking 2,000 lb. of green hops per hour. Thus if such a machine, working night and day, makes two 10-hour shifts in the 24 hours, it will pick 40,000 lb. of hops per day. If these be loaded on to hot-air kilns with a fan draught at the rate of 10 lb. per sq. ft. at each loading, which will be roughly 1½ bushels per sq. ft., each machine will keep five 20-ft.-square kilns supplied with hops, and produce rather more than 10,000 lb. of dry hops per day.

The cost of erection of one of these hop-picking machines in California amounts to about £700. It is roughly estimated that, under the conditions prevailing in California, the saving in the cost of picking by this machine amounts to rather more than 1*d.* per lb., or about 10*s.* per cwt. of dry hops, the interest on the capital and a high rate of depreciation being, of course, included in the calculation.

The economic value of the machine is questioned by many growers on the coast, but under the conditions prevailing in California there is little doubt that the machine is a great success. It is true that as a set off to the reduced cost of picking there are several disadvantages. For example, the bines are severed from the rootstock, which consequently can store up no reserve material from the foliage as this ripens. Again, it is difficult to suppose that the picking machine makes a clean job of the picking, and a considerable amount of hops must be left upon the bines. Lastly, by this method of picking it is probable that the hops become more broken than if picked by hand. It must be admitted that these criticisms lack poignancy, because I did not see the machine at work.

In British Columbia, where the Horst Company have also had the machines in operation, conditions are less favourable to success. In this region, the climate being moister, the foliage grows more luxuriantly and the laterals much longer than in California. Naturally this excess of foliage, and particularly the long laterals, are more difficult to deal with. The laterals tend to become wrapped up in the machinery and so cause a block. On account of these troubles various modifications of the machinery have been introduced, and it is probable that the machinery will be equally satisfactory in British Columbia shortly.

The next point to be discussed is whether or not it would be economical to introduce such a machine into England. In order to arrive at a satisfactory conclusion there appear to be two main problems which need discussion: (i.) will a saving in the cost of picking be effected, and (ii.) how will the crop per acre be affected?

(i.) In consideration of the first problem it will be remembered that the usual plan on the Pacific Coast is to put two strings to each hill. In England, on the other hand, sometimes three and sometimes four strings are put to each hill. Thus the actual time required to pick an acre of hops in England with this machine would be once and a half or twice as long as in California, according as there are three or four strings to each hill.

Further, the cost of the manual labour for picking is in England very much less than in California, the relative cost being *2s. 6d.* as against *8s.* per day, and hence the saving in cost of picking by the machine would be very much less in England than it is in California.

(ii.) As regards the second problem, it must be remembered that under the conditions prevailing in the English hop-gardens (a humid climate, abundant manuring, and short strings), the bines and laterals become matted together, and frequently the hops fail to grow out well. Under such conditions the picking machine would be at a disadvantage, and it seems probable that many hops would remain on the bines unpicked. The result would be that either a smaller crop would be harvested, or special pickers would have to be provided to pick over the hops.

Again, it has been shown that under English conditions the practice of cutting the bines at picking time does weaken the plant, which in consequence grows less vigorously the following year.

In these circumstances it is questionable whether the picking-machine could be economically introduced to English conditions.

Hop Drying.—The conditions under which hops are dried on the Pacific Coast are much more favourable than in England. This is due to the hot dry climate which is prevalent at picking time, rain very rarely falling except in British Columbia. As a result of this the dryer is neither hampered by wet hops, nor by difficulties in obtaining a draught owing to fogs. Moreover, in the drier atmosphere of the West the ripe hops contain a slightly lower percentage of moisture, and thus are easier to dry and require less fuel. Again, the hop-kilns, being all of recent construction, are usually conveniently arranged, and of ample size and height.

Another great convenience which the Pacific Coast hop-dryer enjoys is the possibility of storing the dried hops for a week or two before packing. This, again, is due to the uniformly dry weather, which precludes the possibility of such hops absorbing water and becoming cold-packed.

Hop Kilns.—There are no open-fire kilns on the Pacific Coast, since anthracite coal is not obtainable. Fuel in the shape of lumber, however, is very cheap, and this is burnt in some form of closed stove. Crude oil is also very cheap, and in a few cases is also used as a source of heat for hop-drying.

The normal type of hop kiln is a large rectangular structure, built almost entirely of wood, in the form illustrated in the diagram. The size of the drying-floor varies from 18 ft. to 30 ft. square, and is usually raised to a height of from 16 ft. to 26 ft. above the ground. Beneath the drying-floor is the heating room, at one side of which is placed the stove, with its door opening outside the kiln. From the stove the products of combustion are led through a large iron pipe which branches and zig-zags backwards and forwards across the kiln before being led through the wall of the kiln to a chimney. The arrangement of the pipes is similar to the hot-air plant exhibited by Messrs. Whiting Bros. in the hop-drying trials of the Royal Agricultural Society in 1909.

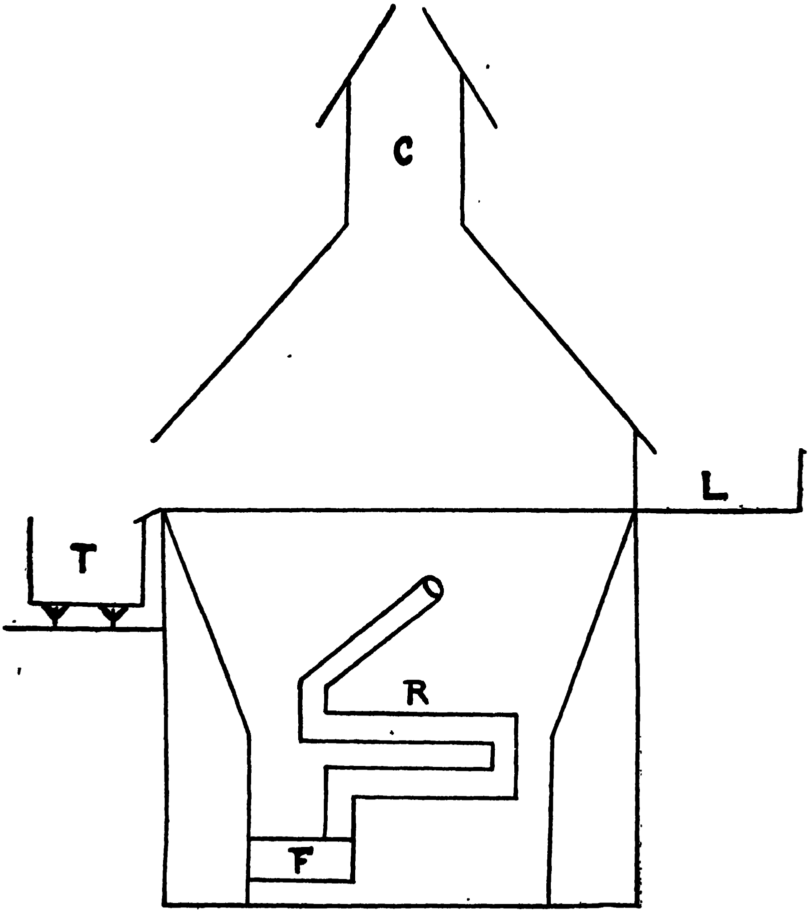


DIAGRAM OF HOP KILN.
F = furnace. R = radiating pipes. C = cupola. L = loading stage for green hops. T = trolley-car for loading dried hops.

The roof is carried up at an angle of about 45° to a height of 15 ft. or 20 ft. above the drying-floor, and opens into a

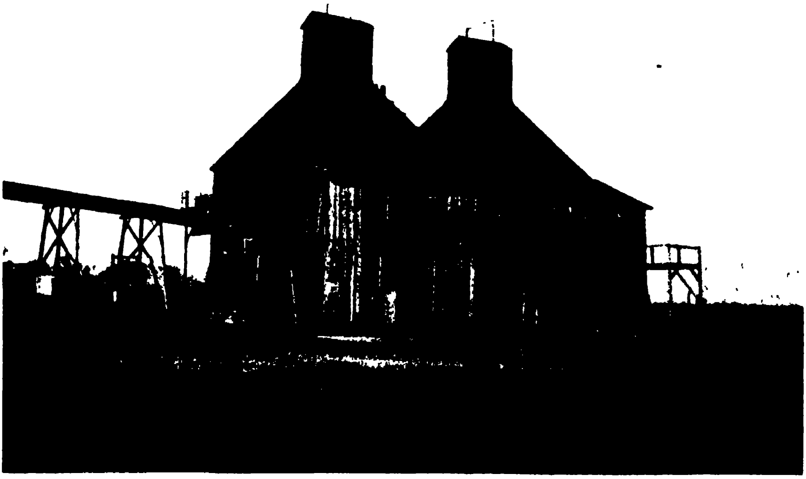


FIG. 1.—HOP OASTS.
Showing cupolas, loading stage, and elevated track for the trolleys

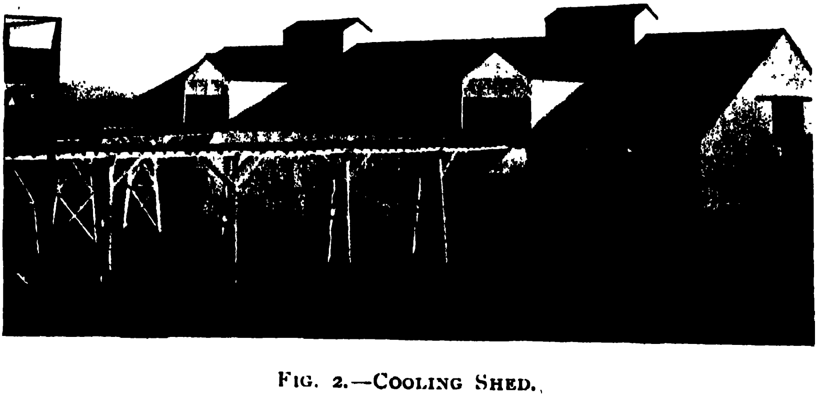


FIG. 2.—COOLING SHED.

wide cupola. The cupola, which is 8 ft. or 10 ft. square and 10 ft. or 12 ft. high, is covered by two or four shutters, which are opened wide whilst drying is proceeding.

The drying-floor communicates with the outside by means of doors or shutters on two sides. On the one side the hops are taken on to the kiln from a loading stage, and on the other side the dried hops are loaded into trolley-cars, in which they are taken from the kilns to the cooling or storage room.

The drying-floors are not covered with hair cloths but with a material called burlap, somewhat similar to the material used for green-bags in England. This requires to be renewed each year, at a cost of about 25*s*. for a kiln 20 ft. square.

It is thus obvious that the kilns differ in many respects from those in England, and are usually more convenient. Their chief advantages are greater height and greater size, but it is at least questionable whether it is an advantage to have the area of the drying-floor greater than 20 ft. square, owing to the difficulty of spreading the green hops uniformly over the larger floors. The majority of the kilns which I saw were constructed upon this general plan, and relied upon the natural draught to produce a current of air through the hops.

The E. C. Horst Company, however, dry their hops with hot air. The method employed consists in drawing air through a set of steam pipes by means of a paddle-wheel fan. The air is heated by contact with the pipes, and is forced by the fan through the hops on the drying-floor. In one of these kilns two drying-floors are situated, the one above the other, so that the air, having passed through the hops on the lower floor, is carried through those of the second. The advantage of this construction is that, supposing the air, after having passed the first floor, is not fully saturated with moisture, it will absorb some moisture also from the hops on the second floor. In theory there would appear to be considerable economy in this arrangement, especially if the second floor is loaded when the bottom floor is half dry, but there are practical difficulties to be met; thus it is difficult to apply sulphur to the top floor hops when the bottom floor is nearly dry; again, the green hops have to be elevated to a greater height; and lastly, hops have to be loaded and levelled on the top floor whilst those on the lower floor are still being dried, and the temperature in which the work has to be done is consequently very high.

Cooling and Baling.—The cooling sheds, which are always separated from the hop kilns, consist of very large wooden storehouses with three or four floors. The hops, which are brought from the kilns in trolley-cars, are at first deposited upon the top floor. This floor has a false bottom, which is taken up when the floor is full, and the hops are dropped upon the floor below; by this process the hops become thoroughly mixed. Usually the hops remain in the cooling shed until picking is finished, when the whole of the hops are baled together.

The baling press is fixed upon the ground floor, with its mouth flush with the first floor, so that it can be easily filled with hops. It is always a rectangular structure standing about 12 ft. high. Two fillings and two pressings are usually sufficient to fill the bale, which is then sewn up. Each bale measures about 4½ ft. × 2½ ft. × 2¼ ft., and contains from 180 to 210 lb. of hops.

The power for baling is in most cases supplied by a single horse working on a windlass, or in some cases manual presses are employed, the power being applied through levers. A gang of six men and one horse will fill and bale 110 bales per day.

Cost of Production (in Oregon).—The task of estimating the cost of production of hops on the Pacific Coast is complicated by the very varying conditions of climate, soil, labour, and other economic conditions which prevail in its several parts. The estimate which follows refers to hops grown in the river-valley yards in Oregon in an average year. It is generally assumed that an average crop in this district is 1,300 lb. of dry hops, or approximately 11½ cwt per acre. The costs are divided for convenience under two headings: (i.) Capital outlay; (ii.) Annual cost of production.

(i.) Capital Outlay—	Per acre. £	s.	d.
Land (cleared from trees and ready to plant) ...	25	0	0
Cuttings and planting same	2	0	0
Trellis	10	0	0
Cultivation, 1 year...	3	0	0
Oast, Cooling Room, Baler, etc.	15	0	0
	£55	0	0

The figure of £50 to £60 per acre is generally accepted in Oregon as being the value of a hop-yard completely equipped with trellis and oast buildings.

(ii.) Annual Cost of Production—

			Per acre.		
	s.	*d.*	£	*s.*	*d.*
Manures			Nil		
String			1	0	0
Horse Cultivation			3	0	0
Manual Labour (contract for preparing and tying string, pruning, training, and hoeing)			3	10	0
Spraying, twice			1	0	0
Picking, per cwt.	20	0			
Drying ,,	6	0			
Baling ,,	2	0			
	28	0			
I.e. picking, drying, baling a crop of 11½ cwt.			16	2	0
Interest on Capital of £55 at 6 per cent.			3	6	0
Depreciation and Repair of Buildings and Land— Five per cent. on Capital of £55			2	15	0
Management			1	0	0
			£31	13	0

It will be noticed that interest on capital is charged at the apparently high rate of 6 per cent.; this is, however, the prevailing rate of interest for mortgages on hop land on the Pacific Coast.

One other item in the cost of production needs explanation, *viz.*, depreciation and repairs of buildings and land, which have been charged at 5 per cent. It will be remembered that the buildings are entirely of wood, and consequently these and the trellis require a considerable outlay to keep them in repair. The same interest has also been charged upon the depreciation of the land; for it has been shown earlier in this article that, since manuring is not generally practised in the hop-yards of Oregon, the soil tends to become slowly impoverished. The sum of these two items, interest on capital and depreciation, amounting to £6, may be regarded as rent, and if compared with the normal crop rent in Oregon (¼ or ⅕ of the crop), it is seen that this figure, £6, is not high, for the sum usually obtained from such a crop rent will fluctuate from £6 up to £15 per acre.

If an average crop of 11½ cwt. costs £31 13*s.*, the cost of production per cwt. is 55*s.*, or approximately 6*d.* per lb. This figure is again generally recognised as being the average cost of production of hops in Oregon. In most parts of California the same cost, 6*d.* per lb., is accepted as being correct. In a few gardens in the Sacramento District, where conditions of soil are exceedingly favourable, the cost is estimated to be as low as 5*d.* per lb. This figure, however, is exceptional.

The freight rate of hops from the Pacific Coast to London is 1*d.* per lb., or to include local freight in Oregon and warehouse delivery in London 1½*d.* per lb. Thus the cost of production of hops in Oregon and delivery in London, but excluding dealer's commission, amounts to 7½*d.* per lb., or £3 10*s.* per cwt.

In conclusion I wish to express my great thanks to Mr. John Carmichal of Salem, Oregon, who in addition to giving me great help at Salem, has kindly read through and criticised the subject matter of this article.

PREES COTTAGERS' COW CLUB.

PREES is a large rural parish in Shropshire, about five miles from Whitchurch. Of the 9,050 acres under crops and grass, 783 acres are under clover and rotation grasses, and no less than 6,569 acres are under permanent grass. There are in the parish 3,551 cattle, including 2,145 cows and heifers. The farmers, both large and small, devote themselves mainly to dairying, and make most of their profits from the sale of milk, cream, butter, and cheese. The cows kept are mostly Shorthorns, and the average value of the cottager's cow is between £12 and £15.

The parish contains 221 agricultural holdings of above one acre, of which 44 are above fifty acres and 177 are between one and fifty acres, 63 of these being between one and five acres. Thus it is to a considerable extent a parish of small holders. A number of them own their holdings; others pay rent at the rate of £2 to £3 per acre. Most of the small holders are said to be prospering, and many of them have in recent years either purchased their holdings or increased their rented area.

As long ago as 1838 a cow insurance society, called "The Prees Cottagers' Cow Club," was started with the object of insuring its members against losses of cows or calves from death by disease or accident. It was registered under the

Friendly Societies Act in 1857. It has now 179 members, and in 1911 insured 453 cows and 84 calves. During the last ten years it has paid insurance on 91 cows and 17 calves, which gives an average rate of mortality of 2·1 animals per cent. per annum. The average rate has been the same for calves as for cows. In its best year the deaths were only 0·9 per cent., and in its worst year 3·3 per cent. Until 1910 it paid the market value, not exceeding £10, of any insured cow that died from disease or accident; in the last two years the maximum payable has been raised to £12. For a calf over six months old the amount payable is its value, not exceeding £5 (after a heifer calf is sent to the bull, it counts as a cow); for a calf between three and six months old £2 is paid.

During the last ten years the amount paid on claims has averaged £100 1*s.* 5*d.* per annum, which gives an average of £9 5*s.* per animal. (The average paid per cow was £10 4*s.*, and per calf £4 7*s.*) A simple arithmetical calculation shows that, to meet the risk of having to pay £9 5*s.* on 2·1 per cent. of the animals insured, an income of 3*s.* 10½*d.* per animal insured would be required per annum. As a matter of fact, the rates of premium charged to members are 4*s.* for each cow and 3*s.* for each calf per annum, and the actual realisations from premiums have averaged £101 9*s.* 7*d.* per annum, just enough to cover the actual losses paid.

Besides the premiums, the Club has had an average income from the sale of carcasses of £4 13*s.* 2*d.*, and from interest on its reserve fund of £22 5*s.* 10*d.*, while its expenditure on cost of management has averaged only £6 9*s.*, which was met by special contributions levied on members, and other income. Thus, the average income of the insurance fund from all sources having been £131 15*s.* 1*d.*, and the average amount of insurance losses charged against it only £100 1*s.* 5*d.*, the insurance or reserve fund has mounted up in the ten years from £724 to £1,040. This sum, with the exception of a small amount left in the Treasurer's hands to meet urgent claims, is deposited in the Savings Bank, and earns the Society about £26 a year interest.

The members are almost entirely small holders or cottagers. Few of the larger farmers have joined, partly because of a rule that no member can have insured at one time more than five cows, or more than seven animals altogether.

The affairs of the Club are managed by a Committee of seven members, elected annually, who appoint a Chairman from among themselves, by a Secretary, a Treasurer, and four Stewards. The Secretary, Mr. Taylor, the schoolmaster, who has held the post for thirty-one years, receives a small remuneration. The only other charges paid by the Club, besides printing, stationery, &c., are 1*s.* paid to the steward on the death of an insured animal, 1*s.* 6*d.* paid to an Advisory Committee if assembled to value a sick animal, and 1*s.* 9*d.* paid to the ordinary Committee if specially summoned; and, as already said, the total expenses of management have averaged only £6 9*s.* per annum, or 3*d.* per animal insured. Each steward has an area assigned to him, within which he marks any animal a member may wish to insure in accordance with the rules. He has to satisfy himself that the animal is sound; then he brands it on the horn or hoof with the Club's brand, and enters its description and the name of the owner in his book. When an insured animal falls ill or meets with an accident, the steward is sent for to value it and to see that all that is possible is done to cure it. He generally calls in an ex-steward or a member of the Committee to assist him in this duty. He receives from the owner 3*d.* for each animal marked, besides the 1*s.* he gets from the Society on each insured animal that dies, and 1*s.* he receives for attendance each quarterly night. There is no difficulty in getting good experienced men to accept the responsible office of steward, and the steward's valuations are rarely disputed, either by the owner or by the Society.

A member, besides paying the premium of 1*s.* per quarter for each cow, and 9*d.* per quarter for each calf insured, has to pay an entrance fee of 1*s.* for each cow and 6*d.* for each calf and an annual subscription of 2*d.* per animal towards management expenses: so that his total annual payments per cow are 4*s.* 2*d.* He is also liable to a levy of so much per animal insured (not exceeding 1*s.* at any one time), should it become necessary in order to find funds to pay losses, but no such levy has had to be made for many years; and with a reserve fund of £1,040 it is very improbable that

Prees Cottagers' Cow Club.

Year.	No. of Animals Insured at the end of the Year.		No. on which Insurance was paid during the Year.		Rate of Mortality per cent. for all Animals Insured.	Insurance Fund.						Management Fund.	
	Cows.	Calves.	Cows.	Calves.		Amount paid on Claims.	Amount received in Premiums.	Interest.	Sale of Carcasses.	Total Income of Insurance Fund.	Amount of Insurance Fund at end of Year.	Total Expenses of Management.	Contributions and Levies of Members for Management.
						£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1902	406	62	8	—	1·7	72 17 0	94 19 5	18 0 7	—	117 4 0	768 1 10	5 12 0	4 0 6
1903	425	73	11	1	2·4	112 10 0	95 15 8	18 16 4	12 10 0	132 2 3	787 14 1	6 0 5	3 19 2
1904	437	78	12	—	2·3	110 12 6	99 17 10	19 15 8	—	123 6 0	800 7 7	6 14 11	4 1 1
1905	409	77	4	4	1·6	57 0 0	100 7 5	19 19 2	3 4 9	127 5 2	870 12 9	5 10 5	4 5 9
1906	445	73	8	2	1·9	86 0 0	99 7 9	20 16 1	—	124 10 9	909 3 6	5 11 7	4 2 6
1907	444	76	3	2	1·0	45 0 0	102 3 10	22 4 5	4 18 0	133 9 5	997 12 11	5 14 4	4 4 0
1908	455	83	4	1	0·9	37 0 0	102 10 6	23 10 9	—	129 3 7	1089 16 6	4 19 8	4 7 6
1909	463	85	15	3	3·3	168 5 0	104 16 11	25 17 2	7 6 0	140 10 1	1062 1 7	6 13 2	5 13 2
1910	486	99	14	1	2·4	159 10 0	106 19 10	27 6 5	12 9 0	147 5 3	1049 16 10	12 6 10	7 5 4
1911	453	84	12	3	2·8	152 0 0	107 16 7	26 11 7	6 4 0	142 14 5	1040 11 3	5 6 11	4 10 8
Average for ten years..	442	79	9·1	1·7	2·1	100 1 5	101 9 7	22 5 10	4 13 2	131 15 1	—	6 9 0	4 13 0

any levy will ever become necessary. If a member loses or parts with an insured animal, he can have another marked in her stead, but she must be on his premises for forty-eight hours before being marked, in order that the steward may be better able to judge of her soundness and freedom from disease. Nothing is payable by the Society on any animal that has not been marked. When an insured animal falls ill, the owner must at once call in the steward, and is bound to use every means in his power for its recovery, at his own expense. If the animal dies, the hide and carcass belong to the Society, which has recently contracted for the sale of all carcasses at the price of 15*s*. each.

Here, then, we have a society of small holders, who have for seventy years run a successful system of insurance, under which the members, in return for a payment of 4*s*. 2*d*. per cow per annum, receive the value up to £12 of every insured cow that dies from disease or accident, and have built up a reserve fund of £1,040, which secures them against the risk of having to make a levy to meet losses. Its success is due to the healthiness of the locality, to the care with which the members look after their cows, to the fairness with which they treat each other, to the trustworthiness and good judgment of their successive stewards and committee-men chosen from among themselves, and to the accuracy with which their accounts have been kept by their Secretary. Where similar circumstances exist, and men of like character can be found, there seems no reason why other communities of small holders should not follow the example of the Prees Cottagers, and by forming a co-operative insurance society, insure their cows up to £12 against death by disease or accident for something like five shillings a year.

Preliminary Report on Grant for Horse Breeding.

The Preliminary Report of the Animals Division of the Board as to the administration of the grant of £40,000 for the encouragement of the light horse breeding industry has been recently issued [Cd. 6271, price 3½*d*.].

It records the operations of the Board from the time of the award of the grant —January, 1911, to 1st April, 1912.

It will be noticed from the Report that the Board are endeavouring to secure an improvement in the breeding of light horses by the provision of high-class thoroughbred stallions for the service of half-bred mares at a low fee, and of some 800 selected mares free of charge. In order to encourage the keeping of brood mares of substance and quality for breeding purposes, the Board, through the agency of County Committees, are arranging for the annual purchase of some 200 mares at an approximate cost of £10,000 for leasing out to suitable custodians; and with a view of placing on the road as many stallions as possible that are free from hereditary disease and suitable for breeding purposes, the Board undertake to examine stallions free of charge and to issue certificates of soundness to all that pass inspection.

Two shows of thoroughbred stallions have been held by the Board in connection with the Hunters Improvement Society during the period under review, and 50 premiums averaging £180 were awarded at each of them.

At the show held in March last, the stallions exhibited were reported by the judges to be considerably superior in merit to those paraded in 1911, and it is a significant fact that no fewer than fifteen stallions winning in 1911 failed to secure awards this year. Two innovations were introduced this year which were well received by exhibitors—one was the veterinary examination of stallions intended for exhibition prior to entry, and the other was the award of an additional subsidy of 100 guineas to each of the best ten stallions to which premiums were awarded, and the winners of these super-premiums were reported by the judges to be horses of an exceptionally high standard.

The results of the service season of 1911 were satisfactory, the average number of mares served by each stallion being 65.

An interesting feature of the Report is an account of the steps taken to revive the breeding of some of the hardy native types of horses and ponies in Wales and Scotland. In Pembrokeshire and Carmarthenshire, where the useful old Welsh light cart horse, known as the pack horse or roadster, has, by cross-breeding and from other causes, been steadily deteriorating and disappearing, assistance to the extent of £400 has been given to each County Committee to purchase suitable mares of the old type and provision made for the hiring of stallions for mating with them.

A grant of £400 has also been made to the County Committee for Inverness for the purchase of typical Highland pony mares to be mated with selected stallions of the breed.

The Board are also prepared to give assistance for reviving the breeding of the Devon pack horse, but owing to the difficulty of finding horses of that type no grant has as yet been made for the purpose.

Steps are also being taken to encourage the breeding of the old type of Welsh cob, and funds have been provided for subsidising pony stallions of the Mountain and Moorland breeds (*i.e.*, Fell, Welsh, New Forest, &c., &c.).

Reference is also made to a very interesting experiment that is being carried on by Captain Dealtry Part, who has most generously undertaken to defray the cost of it to the extent of £10,000. The experiment is based on the Mendelian theory of breeding, and the lines on which it should proceed have been suggested by Professor J. Cossar Ewart and Major C. C. Hurst. The object of the experiment is to secure the formation of a new strain or breed of horse that will always breed to type, and the results will, it is hoped, provide much useful information to horse-breeders and others.

The Report concludes with a tribute to the great assistance given to the Board by the members of the Advisory Council and County Committees, on whose hearty co-operation the success of the operations so largely depends.

The Anthonomus of the Raspberry and Strawberry (*Anthonomus rubi*, Herbst).

The larvæ of a number of species of *Anthonomus* have been proved to be enemies of buds and young fruits. One of the most troublesome in Britain is the Apple Blossom Weevil (*Anthonomus pomorum*) described in the Board's Leaflet No. 15.

Another species (*Anthonomus rubi*, Herbst.) is an enemy of Rosaceous fruit plants; raspberry, bramble, strawberry, plum and rose have been named as host plants. The specific name *rubi* indicates the belief that this weevil is chiefly an enemy of the genus *Rubus*, and on the Continent it is certainly best known as affecting raspberry; and it is on the raspberry that the life-history of the weevil has been worked out. In England, however, of late years, there have been complaints of serious injury to strawberry by this *Anthonomus.* It seems to have been known to strawberry growers for some time now as an enemy, without much mention being made of the fact in our economic literature. Theobald, in his Report on Economic Zoology, 1907, mentions Mr. G. Fenoulhet as recording "considerable damage to strawberry plants at Wye and later in Buckinghamshire." In 1911 a correspondent of the Board of Agriculture and Fisheries intimated that *Anthonomus rubi* was well-known locally as attacking strawberries, and in April, 1912, another correspondent sent specimens of the weevil, with the following note:—"These insects do hundreds of pounds of damage to the strawberry crop in this district (Southampton) in a few days, often destroying quite half of a most promising crop. It generally appears in May by hundreds. I have counted as many as 50 blooms on a good plant destroyed from morning to night." A common local name among strawberry growers for *Anthonomus rubi* is the "snout" beetle or "elephant," a name due to the marked proboscis.

The damage done by the insect is caused both by the adult and the grub. The adult weevil lays its eggs in the unopened buds, and later the grub, on hatching, feeds inside the bud; the adult also punctures the flower-stalks so that they droop.

DESCRIPTION: *Adult.*—The weevil is black with a scanty grey pubescence; the proboscis is long and slightly curved; from the tip of the proboscis the bent antennæ project,—they are dark in colour, sometimes partly brown. The thorax is narrow in front, and wider behind, and is markedly punctured. The wing-covers showed marked striæ and punctures, and the spaces between the striæ are somewhat arched. The legs are black, and have the femora weakly toothed. In size the weevil measures 1/10 in. and over, excluding the proboscis. There is some variation in size and colour.

Larva.—The grub is whitish and slightly hairy; its head is yellow and its mouth-parts brown.

LIFE-HISTORY.—The adult beetles emerge from their winter shelter places in April and May, and appear on the plants before the buds have burst. The weevil punctures a bud with its proboscis and then lays an egg, which it pushes into the centre of the bud. In order to prevent the bud from expanding and thus depriving the future grub of its shelter place, the weevil, with interesting instinct, as soon as an egg is laid, punctures the stalk of the bud, which consequently droops, or may fall. "The buds attacked by the weevil soon show that they have been tampered with, for in about two hours they droop from above the puncture." (Fenoulhet and Theobald.) As the weevils proceed from bud to bud in their egg-laying it is easy to understand the loss that follows this infestation.

In due course the egg in the bud hatches and the grub completes its growth, nourishing itself on the central tissue of the spoiled bud. When full grown the grub pupates in the bud, and the new adults issue in late summer. These nourish themselves on leaves which are punctured for the purpose. It would appear that this new brood of beetles does not proceed to reproduction until the following spring.

From the life-history it will be seen that *Anthonomus rubi* is difficult to fight. Careful watch should be kept for the appearance of the beetles in spring, when they should be netted or shaken off the plants into dishes that are tarred or contain paraffin.

Population of Agricultural Districts.

Particulars of the changes in the population of agricultural districts in the past 60 years are given in Volume I. of the Census of England and Wales [Cd. 6258, price 5*s*. 4*d*.], recently issued.

So many changes have taken place from time to time in the boundaries of urban and rural districts that it is impossible in many cases to ascertain what was the precise population at censuses previous to that of 1911. The following table, however, shows the population of the urban and rural districts as constituted at each of the past seven censuses, and gives some idea of the increasing predominance of the urban as compared with the rural element in the population.

It will be noted that while in 1851 the numbers of persons living under urban and rural conditions were, broadly speaking, evenly distributed, in 1911 no less than 78 per cent. of the population were living under urban and only 22 per cent.

under rural conditions. The increase in the proportion of the population resident in urban districts is, however, partly to be accounted for by the extension of those areas themselves, owing to the absorption of areas which were previously rural. Thus the population in 1901 and 1911 of the rural districts as constituted in 1911 was 7,176,725 and 7,907,556 respectively, showing an increase of 10·2 per cent., as compared with 10·9 per cent. for the whole of England and Wales, and 11·1 per cent. for urban districts; while in the preceding intercensal period the rates of increase in the urban and rural districts (as constituted in 1901) had been 15·2 and 2·9 per cent. respectively; so that while the rate of increase in urban districts has declined from 15·2 to 11·1 per cent., the rate of increase in rural districts has risen from 2·9 to 10·2 per cent. It should be pointed out, however, that the rates in the last decennium represent an actual increase of 2,811,818 persons in the urban and of only 730,831 persons in the rural districts.

	Population.			Proportion per cent. to total population of England and Wales.	
	England and Wales.	Urban Districts “as constituted	Rural Districts at each Census.”	Urban Districts.	Rural Districts.
1851	17,927,609	8,990,809	8,936,800	50·2	49·8
1861	20,066,224	10,960,998	9,105,226	54·6	45·4
1871	22,712,266	14,041,404	8,670,862	61·8	38·2
1881	25,974,439	17,636,646	8,337,793	67·9	32·1
1891	29,002,525	20,895,504	8,107,021	72·0	28·0
1901	32,527,843	25,058,355	7,469,488	77·0	23·0
1911	36,070,492	28,162,936	7,907,556	78·1	21·9

A point of some importance in a discussion of the population of rural districts is that in many cases small towns in the midst of agricultural areas are dependent on these areas for their maintenance as business centres. Bv including in the rural areas the towns with populations of less than 10,000, the urban element in the population is reduced from 78 to 70 per cent., and the rural element is increased from 22 to 30 per cent.

The rural population was found to be decreasing in Cumberland, Hereford, West Suffolk, Westmorland,. Anglesey, Cardigan, Carnarvon, Merioneth, Montgomery, and Radnor, though the decrease in each case was small.

Application of Different Names to the same Variety of Seed.

The attention of the Board has recently been drawn to the practice of applying different names to the same variety of seed, and to the loss and confusion which is thereby occasioned, both to purchasers of seeds and sellers.

When a new variety of a plant is raised by a grower, and named by him, and the seed is placed on sale, other growers obtain some of the seed, grow it for sale, and, instead of retaining the original name, apply to it names of their own. In this way it may frequently happen that many names may be in use for one variety of seed.

It is evident that in these circumstances the purchaser of seeds for growing must often be at a loss in selecting the seed which will yield him the most satisfactory results. It is possible that he may have already tried, under another name, seeds which are being offered to him, and found them unsuitable, or that he could obtain the same seed under another name at a lower price. The grower of a new variety, also, suffers a distinct disadvantage, as he may be prevented by unscrupulous competitors from deriving any benefit from his discovery; and this fact may operate as a check on enterprise in establishing new varieties of plants which might benefit agriculture and horticulture.

From inquiries which the Board have made it appears that the evil is of a serious nature, but, so far as the Board are able to ascertain, no effective steps are taken by any of the Societies interested in agriculture or horticulture to check it.

It is not easy to suggest precisely what methods should be adopted for dealing with the question, but the Board think it desirable that the attention of those interested should be called to the subject. In this connection, reference may perhaps be made to the article on the "Sale of Seeds by the German Agricultural Society," which appeared in the *Journal* for June, 1909. This contains an account of the method of registration adopted by this Society with a view to check the practice referred to. The aim of this method is, briefly, to protect the breeder of new varieties by giving him the exclusive right to describe his seeds as "Entered in the Pure-bred Seed Register of the German Agricultural Society," and to use a legally protected trade-mark, the registered seeds being sold by the Seed Bureau of the Society. For admission to the Register, proof of the work of selection over a number of years is required, while the value of the variety for agricultural purposes must be shown by independent trials.

Production of Flowers and Fruit in Great Britain.

Flowers.—The extensive cultivation of flowers for market is one of the developments of modern farming of which as yet there has been no record, although in many parts of England its importance as a means of exploiting land which would be less profitably devoted to ordinary farm crops is well recognised. Information which was obtained by the Board in connection with the inquiry under the Census of Production Act, 1906, showed that the counties in which flower-growing is most widely practised are Lincoln, Cambridge, Middlesex, Norfolk, Devon, Somerset, Cornwall, Cheshire, Lancashire, West Riding, Sussex, Kent, Hampshire, and Surrey, but there are very few English counties in which the cultivation of flowers for market is not carried on, while in Wales and Scotland the industry has established itself in a few localities. Among the flowers most extensively cultivated are asters, chrysanthemums, daffodils, dahlias, lilies of the valley, narcissi, nasturtiums, pansies, roses, sweet peas, violas, violets, and wallflowers. The total area devoted to the cultivation of flowers and shrubs appears to be slightly more than 4,000 acres, and the gross value of the production is put at £121,000.

Fruit.—The acreage returned in 1908 as occupied by orchards was 250,297 acres, of which 27,433 acres bore small fruit as well as tree fruit. The area devoted to small fruit alone was 57,447 acres, so that altogether the acreage of small fruit (on holdings exceeding one acre) was 84,880 acres. The annual agricultural returns distinguish the acreage of (1) strawberries, (2) raspberries, and (3) currants and gooseberries combined, but by the special inquiries made by the Board more detailed returns were obtained, and the total small fruit acreage was found to comprise strawberries 28,815 acres, raspberries 9,323 acres, black currants 5,939 acres, red and white currants 3,761 acres, gooseberries 16,541 acres, and other kinds, including land under mixed fruit, 20,501 acres. The allocation of the orchard area was—apples 172,751 acres, pears 9,604 acres, cherries 11,868 acres, plums 15,683 acres, nuts 2,968 acres, and other kinds, including land under mixed fruit, 37,423 acres.

Growers making these returns were asked not only to state the quantity of the crop grown in 1908, but also to give an estimate of the average yield per acre in an ordinary year. The replies showed that the fruit crops in that year were considerably below the average.

Crop.	Quantity.	Value.	Yield per acre in 1908.
	cwt.	£	cwt.
Strawberries	829,000	1,036,000	29
Raspberries	206,000	309,000	22
Black currants...	56,000	84,000	9
Red and white currants...	68,000	69,000	18
Gooseberries	347,000	208,000	21
Other kinds (including mixed)	252,000	252,000	—
Total small fruit	1,758,000	1,958,000	—
Apples	4,486,000	1,490,000*	26
Pears	183,000	90,000*	19
Cherries	176,000	194,000	15
Plums	715,000	357,000	46
Other kinds (including nuts and mixed)	812,000	406,000	—
Total orchard fruit	6,372,000	2,537,000	—
Total all fruit	8,130,000	4,495,000	—

* Including value of fruit used in making cider and perry.

Cider and Perry.—The manufacture of cider and perry on farms accounts for about 45 per cent. of the apple crop and about 25 per cent. of the pear crop. About 2 per cent. of the whole crop of apples and pears is made by farmers into cider-perry, but the exact proportions of each fruit used for this purpose cannot be calculated from the returns.

The quantity of apples thus used in cider-making, and the quantity and value of the cider made therefrom, are shown in the following table for each of the chief cider-making counties:—

County.	Apples used on farms for cider making.	Cider produced on Farms.	
		Quantity.	Value.
	cwt.	Gallons.	£
Devon	759,000	5,347,000	101,000
Somerset	477,000	4,177,000	107,000
Hereford	212,000	2,771,000	47,000
Worcester	145,000	1,411,000	31,000
Gloucester	135,000	1,191,000	28,000
Dorset	98,000	793,000	16,000
Monmouth	67,000	756,000	18,000
Salop	60,000	658,000	13,000
Cornwall	34,000	281,000	7,000
Other Counties	54,000	458,000	13,000
Total	2,041,000	17,843,000	381,000

The total value of cider sold by the growers is calculated at £108,000. There was also a large output from factories,* which does not come into these returns except in so far as farmers sold their cider to them.

The manufacture of perry appears to be practically restricted to the four counties of Gloucester, Worcester, Hereford, and Monmouth. The total quantity produced in 1908 was 382,000 gallons, valued at £8,000, and the quantity sold was valued at rather less than £2,000. Gloucester produced 182,000 gallons valued at £3,600, Worcester 97,000 gallons valued at £2,300, and Hereford 89,000 gallons, valued at £1,700.

Cider-Perry is returned as made in the five counties of Worcester, Gloucester, Hereford, Monmouth, and Shropshire. The total production was 1,200,000 gallons, valued at £21,000, the quantity sold being valued at £5,000. About half the total produced, both in quantity and value, was made in Worcestershire.

Crops under Glass.—The great extension which has in recent years taken place in the cultivation of crops under glass has considerably increased the total output of the land. At the outset of these inquiries it was hoped that it might be possible to obtain a sufficient number of returns to afford a basis for a calculation of the total value of the crops so produced. A schedule was prepared and circulated, and 57 returns were received from 23 different counties. The difficulty, however, of forming any satisfactory estimate of the proportion which the areas thus returned formed of the whole extent of land under glass, or in what degree the returns received were typical, precludes the possibility on this occasion of making a calculation of the total production.

---

* The total output of cider and perry factories in the United Kingdom in 1907 was 2,708,000 gallons, estimated at £153,000. [Cd. 5397.]

Among the crops included in one or more of the returns received, tomatoes were the most widely grown, being included in 45 returns from 22 countries. The value of the crop so returned was £43,000. Many of the returns did not state the extent of glass under which the crop was grown, but from those in which the area was stated, it appeared that on 20 acres a crop of over 600 tons was cut, being an average yield of over 30 tons, valued at £830 per acre. Next to tomatoes, cucumbers, grapes, and chrysanthemums seem to be the crops most largely grown under glass, but other crops included in more than one return were strawberries, peaches, lettuce, radishes, beans, rhubarb, and narcissi. The returns in which the area of the glass and the value of the produce of all crops grown thereunder was given represented 155 acres, with a total output of £150,000, or £968 per acre.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

MANURES.

Factors Influencing the Availability of Rock Phosphate (*Univ. of Wisconsin Agric. Expt. Sta., Research Bull.* 20).—Experiments carried out at various experiment stations in the United States had indicated that when finely ground raw rock phosphate was used along with a liberal supply of organic matter, such as farmyard manure or crop residues, its efficiency was greatly increased. The work described in this bulletin was designed to test whether this increased efficiency was due to a solvent action of the decaying organic matter.

In a preliminary experiment, finely ground rock phosphate was mixed with grass or manure, and quartz sand, and allowed to remain in glazed pots for four months, during which period the pots were regularly watered. Active fermentation appeared to take place, and at the end of the period the material in each jar was extracted with water;

---

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

several weeks later, extractions were made with a 0·2 per cent. solution of citric acid, and other portions with a 1 per cent. solution of sodium hydrate. Comparing the results with those obtained from control pots, it was seen that the fermenting organic matter had decreased rather than increased the amount of phosphate extracted by the various solvents.

It, however, seemed possible that the phosphate had been made soluble to a certain extent, but that the soluble portion had been taken up by the organic matter, and held in such a way that citric acid solution would not extract it.

Further experiments were arranged to test this point, but it was not found possible to demonstrate directly that the fermenting organic matter had increased the availability of the phosphate in the soil. It was, however, found that the addition of farmyard manure to a soil resulted in a large increase in the carbon dioxide production in that soil, and that air from manured soils when bubbled through a mixture of water and ground phosphate resulted in the solution of a greater quantity of phosphate than did air from an unmanured soil in a corresponding experiment. It is, therefore, suggested that the manure had exerted a solvent action on the phosphate in contact with it. The failure to demonstrate this directly is taken to show that the methods adopted were not suited for the purpose in view.

Incidentally, attention is called to the importance of fine grinding and thorough mixing with the soil as factors influencing the availability of raw rock phosphate.

Manuring of Meadow Hay (*Journ. Dept. of Agric. and Tech. Instr. for Ireland, April,* 1912).—The series of experiments on the manuring of Meadow Hay instituted in 1901 was continued in 1911 at eleven centres in eight counties in Ireland. The plan of the experiment and the weights of crop obtained in 1911, together with the average results for the previous ten years 1901–10, are shown in the following table :—

Plot.	Manure per statute acre.	Cost of manure per acre in 1911.			Average yield per acre in 1911.		Average yield per acre for ten years, 1901–10.	
		£	s.	d.	Tons.	Cwt.	Tons.	Cwt.
1	No manure		—		1	15	1	11
2	10 tons farmyard manure	2	0	0	2	8	2	3
3	1 cwt. nitrate of soda		11	6	2	4	1	18¼
4	1 ,, ,, ,, 2 ,, superphosphate		18	6	2	5	2	4
5	1 ,, nitrate of soda 2 ,, superphosphate 2 ,, kainit	1	4	0	2	10½	2	8¼

Generally speaking, the mixture of artificial manures used on plot 5 has during the past eleven years given the heaviest yield and greatest profit. The mixture is therefore recommended for meadow land in Ireland.

The Value of Liquid Manure.—An experiment carried out at thirty centres was designed to show the benefit to be derived from the application of liquid manure to the hay crop. For the purpose of comparison, plots dressed with farmyard manure and also with a complete mixture of artificial manures were also included. The liquid and farmyard manures were each used at the rate of 16 tons per acre, and the mixture of artificial manure was that found most satisfactory in the previous series. The average yields from the three manured plots were almost the same, and it is concluded that the benefits attending the collection of liquid manure and its application to grass land are much more than sufficient to compensate for the expense incurred.

DAIRYING.

The Effect of Heavy Root Feeding on the Yield and Composition of Milk (*Edinburgh and East of Scotland Coll. of Agric., Report XXVI.*, Dr. A. Lauder and Mr. T. W. Fagan).—Experiments extending over three years, and made with sixty cows in all, were carried out to test the effect of a ration consisting largely of roots on the yield and composition of the milk, and incidentally to determine how far turnips could profitably replace the more concentrated and expensive foods commonly employed in feeding dairy cows. In each year two lots of cows, as nearly equal as possible in respect of age, period of lactation, yield and quality of milk, were selected. Before the experiments began there was a preliminary trial period of about three weeks, in which the adjustment of the two lots was completed, and in which all the foods to be experimented with were fed. The cows were then gradually put on to the experimental rations. In the second and third years, after the experimental rations had been fed for eight and ten weeks respectively, the rations were crossed, and the experiment was then continued for another four or six weeks. The experimental rations may be briefly described as follows: The "Turnip Ration" consisted of 112 lb. of roots, 15 lb. of hay, and 4 lb. of meals per head per day. The "Ordinary Ration" contained 40 lb. of roots, 15 lb. of hay, and 10 lb. of meals and dried grains per head per day. In addition, straw was fed to both lots. The ordinary ration did not supply quite so much dry matter as the turnip ration, but its albuminoid ratio was very considerably narrower than the latter—in 1911–12 it was 1 : 7·6 as compared with 1 : 14.

The meals and dried grains were supplied to the cows in the form of mashes, which were made up with definite quantities of water. Allowing for the water supplied in the mashes, the cows on the turnip ration received daily nearly four and a half gallons more water per head than those on the other ration. Both lots refused drinking water when it was offered to them from time to time. In all three experiments the milk of each cow was weighed at every milking. In the first two trials the percentage of fat in each cow's milk was determined once a week, but in the third season the fat was determined at every milking.

The total yield of milk of each lot, and the percentage of fat given each year in the first period of the experiment—*i.e.*, before the rations were crossed—are set out in the table on the next page.

In each year the animals in Lot II. gave a higher yield of milk than those receiving the turnip ration. On crossing the rations in the second and third years, the change from the turnip to the ordinary ration caused an increase in yield, while the effect of the reverse change was to hasten the natural falling off due to the advance in the period of lactation of the cows.

Year.	Number of cows and period of feeding.	Lot I (turnip ration).		Lot II (ordinary ration).	
		Yield in lb.	Average percentage of fat.	Yield in lb.	Average percentage of fat.
1909	10 in each lot; 9 weeks	15,240	3·49	15,818	3·09
1910–11	11 ,, ,, 8 ,,	13,920	3·55	14,069	3·35
1911–12	9 ,, ,, 10 ,,	14,345	3·68	15,637	3·26

As regards the fat content of the milk, it is seen that not only was the percentage of fat in the milk from the turnip ration greater than that in the milk from the ordinary ration, but that the absolute weight of fat secreted in the whole period was greater.

It is also pointed out that the amount of fat obtained in the milk was considerably greater than that supplied in the food, and, furthermore, that the richest milk was not obtained from the ration containing the greatest weight of digestible fat. The larger weight of fat which was always obtained from the cows fed on the turnip ration appeared to indicate that the easily digestible carbohydrates contained in the turnips are specially suitable for fat formation.

The percentage of solids-not-fat was determined in the case of two cows of each lot at both milkings on one day a week. In view of the comparatively small number of samples examined, the results are not regarded as conclusive, but the weight of the solids-not-fat secreted was always greater in the case of the milk from the turnip ration than in that from the ordinary ration.

It is concluded that—

1. The feeding of a ration containing a large quantity of water does not increase the percentage of water in the milk, or reduce the percentage of fat.

2. In all three experiments the greater yield of milk was obtained from the cows on the concentrated ration. On the other hand, the milk from the cows on the turnip ration contained a higher percentage of fat, and a greater total weight of fat was secreted in the milk.

3. The cost of production when allowance was made for the percentage of fat in the milk was less in the case of the turnip ration.

4. The condition of both lots of cows was perfectly satisfactory at the end of the experiments.

5. While the milk of individual cows frequently contained less than 3 per cent. of fat, the percentages of fat and of solids-not-fat in the mixed milk of both lots practically never fell below 3 per cent. and 8·5 per cent. respectively, during the course of the experiments.

The Temperature of Pasteurisation for Butter Making (*U.S. Dept. of Agric., Bureau of Animal Industry, Circ.* 189).—The pasteurisation of cream for butter making has for its primary object the elimination of the normal bacteria of the cream to enable the maker to control the ripening, and so to secure a uniform product. It may also remove some of the causes responsible for the production of poor butter, destroy the pathogenic bacteria, and expel gases or other volatile flavouring substances. In pasteurising, the temperature should be sufficiently high to remove as many of the bacteria as possible, but should not be so high as to impart scorched, metallic, or other undesirable flavours to the cream; nor yet to affect the cream in such a way as to cause loss of fat in churning. As no exact information as to the most suitable limits of temperature was available, the investigations reported on were carried out.

The cream used was all sweet and of fair quality; after pasteurisation, which was done in a continuous machine, it was cooled to churning temperature and churned within three hours. The results, therefore, do not throw any light on the growth of bacteria during the ripening of imperfectly pasteurised cream.

Bacteria were counted in composite samples of the pasteurised cream, and it was found that with cream of good quality efficient pasteurisation from the bacteriological standpoint was secured by momentary heating to 160° F. This, however, was near the lower limit of safety, and if the bacterial content of the raw cream was high, a temperature of from 165° to 170° F. was necessary to secure uniform results.

Certain enzymes occur naturally in milk, and when cream is churned they pass into the butter. Their action is undetermined, but it is possible that they take some part in the changes which occur in butter, and it was thought that this possibility makes it desirable that they should be destroyed in cream used for making butter. Four different enzymes were considered, and it was found that the temperature necessary to destroy them varied in different cases; one, galactase, though seriously checked at temperatures between 160° and 170° F., was not totally destroyed at even 200° F.

The butter made after pasteurisation was packed in hermetically sealed cans and stored at 10° F. After about forty days in storage, and again after about 150 days, the samples were examined and points awarded. The result showed a marked difference between the butter from unpasteurised cream and that from the pasteurised. They also indicated that pasteurising temperatures of between 140° and 150° F. leave in the cream some factors causing a deterioration of the butter. Good results were secured from the cream pasteurised at 160°. At 180° some of the samples had a scorched or cooked flavour, though the temperature at which the flavour was affected varied in different samples, and could not be definitely fixed.

It is concluded that for the continuous pasteurisation of sweet cream for butter making a temperature not lower than 165° F., and not higher than 175° F., is to be recommended.

A Probable Effect of Control of Milk-Supply upon Infantile Mortality from Tuberculosis (*Lancet, May 25th,* 1912, Professor Sheridan Delépine.) —In Manchester endeavours have been made since 1896 to prevent the supply of tuberculous milk to the town. Milk arriving in the town is regularly tested by inoculation, and when the milk from any particular farm is found to be tuberculous, that farm is visited by a veterinary inspector, who takes samples of milk from the individual cows. These samples are tested by inoculation, and the farmer is requested to isolate any animal found to produce tuberculous milk. He is also advised to have such a cow slaughtered as soon as possible. Statistics showing the general mortality and that from various forms of tuberculous disease in infants and persons at various ages are given in this article, and the conclusion is drawn that the reduction in the amount of tuberculous milk supplied to Manchester has had a distinctly beneficial effect.

The Composition of Milk (*The Analyst, July,* 1912, Mr. H. Droop Richmond).—In this communication the average results of twenty thousand analyses of milk made during 1911 in the Aylesbury Dairy Company's Laboratory are given. The average percentage of fat, 3·71, was slightly lower than that found in the previous year, principally owing to a falling off in the last months of the year. As is generally found, the lowest percentages of fat occurred in May and June, and the highest in October and November. The average difference (0·30 per cent.) between the content of fat of the evening's milk and that of the morning's is rather less than usual, and the slightly smaller amount of fat found in 1911 is due to that in the evening milk being less.

The proportions of the morning's milks falling below 3 per cent. of fat in April, May, and June were 1·2 per cent., 6·8 per cent., and 6·7 per cent. respectively. In other months samples containing less than 3 per cent. of fat were practically never found.

Solids-not-fat are usually lower in July, August, and September than in other months, but during 1911, which was remarkable for its prolonged drought, and, consequently, shortage of succulent herbage, the deficiency in solids-not-fat in these months was greater than usual. The proportions of the samples which contained less than 8·5 per cent. of solids-not-fat in July, August, and September were 7·9 per cent., 27·0 per cent., and 13·2 per cent. respectively. During the other months of the year few samples were found to contain less than 8·5 per cent. of solids-not-fat.

In order to see which of the constituents of the solids-not-fat was responsible for the deficiency, detailed analyses were made of a considerable number of samples throughout the year. The deficiency appeared to be due principally to the lower content of proteins. The sugar was fairly constant throughout the year, and the ash varied little.

FORESTRY.

Effect of Drought on Japanese Larch (*Quart. Jour. Forestry,* July, 1912).—The planting of Japanese larch in preference to European larch has been advocated in recent years on account of its superior growth when young, and its resistance to disease, and hitherto the only reason against its cultivation has been the lack of knowledge as to whether the Japanese variety will attain the size of the European as a timber tree at the age of 70 to 100 years.

Japanese larch, however, seems to have suffered more from the drought of 1911 than the European variety. In this article the effect of the drought on a 15-acre plantation in Gloucester on a grey loam soil of the Wenlock limestone (Silurian) series is described.

The general conclusions drawn are that on high, dry grass land or on grass land sloping S. or S.E., Japanese larches are by no means free from the risk of wholesale destruction by an exceptional drought unless the crop has begun to suppress the undergrowth. European larch withstood the drought far better than the Japanese, and seems a far safer tree to plant under unfavourable conditions as to rainfall, and under the worst conditions would probably have to be filled up to the extent of only 25 per cent., as against entire replanting of a Japanese crop. However, under a moderate set-back the Japanese variety seems to throw out a new leader, stronger, better, and more quickly than the European, and, taking into account the disease-resisting power of the Japanese variety and the exceptional character of the weather of 1911, it may be well worth planting, and among a strong growth of bracken or for planting up clear-cut coppice woods, provided there is a reasonable amount of moisture in the soil, it may be more useful than European. On the heavy clays of Northumberland, where the effects of the drought were not so severe, the Japanese larch promises to become a far more useful tree than the European, and to give a crop of useful timber where the European could never pay.

Effect of the Drought of 1911 on Forest Trees (*Quart. Jour. Forestry,* July, 1912).—An investigation was carried out by the Royal English Arboricultural Society as to the effects of the drought of 1911 on forest trees, by means of inquiries addressed to correspondents.

With regard to the *nature of the injury,* most of the deaths recorded were due to "withering." In the case of plants crippled but not killed, the ends of the branches and leading shoots generally died. Only a few instances were reported of bark cracked by the heat, the cause of damage being want of water in the soil rather than insolation such as occasionally gives rise to bark scorching in older trees.

As regards *age,* no trees older than six years suffered from the drought. Plantations formed during the planting season immediately preceding the drought suffered most, the failures in trees of this age being 60 per cent. of the total losses. The effects of the drought were manifested in early leaf-shedding, intensified autumn colouring, and increased production of seed.

In respect to *aspect* or *exposure,* there were more cases of injury where the ground was level than where there was a decided slope. Plantations on all aspects were affected, but those facing S.W. were harmed in twice as many cases as on any other aspect.

With regard to *soil,* trees growing in chalky or calcareous soils suffered most. Trees on sandy soils did not suffer so much as on clay soils, while even loam did not escape the effects of drought, sixteen instances of failure on this type of soil being reported. A table given in the article under notice shows the extent of the injury on the various geological formations.

As to the *species,* the outstanding feature is the failure of Japanese larch; the worst injuries were reported from Gloucester, Berks, Hereford, Somerset, Herts, and Kent. Out of twenty-three estates sending in records of this tree, seventeen reported injury; trees up to six years old and 12 or 13 feet high were affected. The European species was not injured nearly so severely. Beech was the worst sufferer among hardwood trees, probably on account of its being used more frequently on calcareous soil. Many cases of injury to Scots pine were recorded, but most of these were in trees planted in 1910–11. Douglas fir withstood the drought very satisfactorily. Certain species were reported as having actually benefited from the drier conditions; amongst these were common larch, robinia, ash, sycamore, Sitka spruce, Douglas fir, and Corsican pine.

Deep Planting of Forest Trees on Sandy Soils (*Allgemeine Forst. und Jagd-Zeitung,* March, 1912, *Abs. Bull. Bur. Agric. Int. and Pl. Dis.,* June, 1912).—The drought of 1911 caused heavy losses in forest plantations in Germany, and to guard against similar losses in future deeper planting, especially in light dry soils, is advocated. The resulting formation of tap roots will, it is claimed, ensure the success of plantations of pine on sandy soils, oak on dry sandy loams, and beech on calcareous as well as on sandy soils.

With regard to the depth, young plants, it is stated, might be planted so that they scarcely appear above the surface, while larger ones might be covered to about half-way up the stem. The expenditure incurred would, it is claimed, be more than counterbalanced by the following advantages: The roots would go deeper and find more moisture, and the moisture deeper in the soil does not evaporate so readily as that nearer the surface. Rain water accumulates in the holes made in planting. The young plants are less exposed to the sun, reducing the probability of the drying of the roots, in addition to which, early development being prevented, the damage caused by the late frosts is obviated. The freezing of young plants is avoided. The growth of grasses and weeds is reduced. The development in height of the young tree in its first stages is encouraged, and damage caused by white grubs would probably be lessened.

OFFICIAL NOTICES AND CIRCULARS.

Foot-and-Mouth Disease.

Since July 8th, the date referred to at the conclusion of the article in last month's *Journal,* Foot-and-Mouth Disease has made its appearance in four fresh centres in Great Britain, namely, at (*a*) Howden, in the East Riding of Yorkshire, where the existence of the disease was confirmed on July 10th; (*b*) Great Bowden, Leicestershire, confirmed on July 14th; (*c*) Batcombe, Somerset, confirmed on July 24th; and (*d*) Bridgemere, in the south of Cheshire, confirmed on July 25th. In each case an Order was at once made by the Board prohibiting the movement of animals into or out of, or along, over, or across a highway or thoroughfare within, a wide area surrounding the infected premises.

Further outbreaks of the disease have, since July 8th, also been confirmed in the following areas already scheduled, namely, in the West Riding of Yorkshire—at Normanton, Birstall, and Dewsbury; in the South Lancashire (Salford) area—at Oldham and Saddleworth; and most recently in the Northumberland area—at Ponteland (Morpeth), Ratcleugh (Alnwick), and Chollerton. It has, however, been possible for the Board to withdraw all the general restrictions from the Lancashire (Blackpool), Surrey and London, and—except very small areas out of which movement remains prohibited—the Cumberland districts, and also substantially to modify the general restrictions imposed on the movement and marketing of animals in all the other scheduled districts. Free movement is now allowed into and within the Lancashire (Liverpool and Salford), Yorkshire (West Riding), Yorkshire (East Riding), and Leicestershire districts, except in small areas surrounding the premises on which the outbreaks occurred. Markets of fat stock may also be held in these districts by licence of the

Local Authority. It has not, however, yet been considered safe to allow the movement of animals out of any of these districts except for the purpose of immediate slaughter only. In the case of Northumberland, restrictions on the movement of animals are being maintained in reduced areas surrounding the three most recent centres in the county, namely, Chollerton, Morpeth, and Alnwick. Certain modifications of the restrictions imposed in the South Cheshire and Somerset scheduled districts have also been made.

The total number of outbreaks of Foot-and-Mouth Disease confirmed in Great Britain during the present year up to August 9th reached 63, which are distributed as follows:—

County.	No. of Outbreaks.
Chester	7
Cumberland	3
Durham...	1
Lancashire	6
Leicester	3
Northumberland ...	26
Somerset	2
Surrey	1
Yorkshire—	
East Riding ...	2
West Riding ...	12
Total ...	63

Nearly all the earlier outbreaks of the disease were directly attributable to Irish animals.

As a precautionary measure, the Board prohibited the exhibition at the Highland and Agricultural Society's Show, held at Cupar on July 9th, 10th, 11th, and 12th, of any animals which had been in England, Wales, or Ireland at any time since June 15th last, and similar action as regards animals from England, excluding Herefordshire and Monmouthshire, was taken by the Board in regard to the Welsh National Society's Show, held at Swansea on August 5th and 6th.

The landing in Great Britain of hay and straw brought from Ireland and intended for use as fodder or litter has been prohibited, and cattle, sheep, or swine from that country are permitted to be landed in Great Britain only from certain specified ports in Ireland, and only at the foreign animals wharves at Birkenhead, Bristol, Glasgow, and London (Deptford), for the purpose of slaughter within the limits of the wharf.

Prices of Agricultural Produce.

Part III. of the Agricultural Statistics of 1911, dealing with the prices of corn, live stock, and other agricultural produce in Great Britain, has been recently issued [Cd. 6272, price 4½d.]. The Agricultural Statistics are now issued in five parts, viz.: Part I., dealing with the area under crops, number of live stock, and value of land; Part II., with the produce of crops and weather statistics; Part III., with prices of agricultural produce; Part IV., with imports and exports of agricultural produce; and Part V., with foreign and Colonial statistics.

The present report, after discussing prices in the past year, gives an account of the supplies of live stock at markets, and the weighing of live stock in 1911.

Methods of Collecting and Utilising Information for a Forest Survey.

With the present number of the *Journal* the Board publish as a supplement * (price 4*d.*, post free) a report on methods of collecting and utilising information for a forest survey as exemplified by investigations as to the growth of timber on mountain soils, carried out in Kerry Hill Woods by one of the Board's inspectors.

The Board are collecting, as opportunities arise, reliable data relating to forestry and afforestation, and, in addition to the present *Supplement,* the reader is referred to the account of Coombe Plantation in the *Journal* for July and August, 1910, Vol. xvii., pp. 265–283 and 353–370, as examples of the type of information considered desirable. The data collected in any one locality will as a rule be incomplete, but it is hoped that, as the work of investigation progresses, it may be found possible to co-ordinate the results into a form which will be a useful and fairly complete guide to those undertaking planting operations.

MISCELLANEOUS NOTES.

Importation of Potatoes into South Africa.—The following restrictions have been imposed on the importation of potatoes into South Africa during the season of 1912.

Importation Regulations.

Declaration of Consignor.—On importation, a statement on oath is required from the consignor, declaring the country and place or places in which the potatoes were grown, and giving data clearly establishing the identity of the consignment.

Certificate by the Board of Agriculture.—Consignments of potatoes from this country must be accompanied by a certificate from the Board to the effect that, at a date not more than thirty days before the time of the dispatch of the consignment, wart disease has not been known to exist within five miles of the place or places in which the potatoes are declared to have been grown.

This certificate is not necessary, however, if the consignee produces a certificate of the Board of Agriculture, dated within nine months of the day of arrival of the potatoes concerned, to the effect that wart disease had not been known to exist in the county comprising the place or places in which the potatoes are declared to have been grown; but an attested copy of this certificate may be required.

Inspection and Treatment of Consignments.—Consignments will be inspected on arrival, and, if found to be affected with wart disease, will not be admitted; consignments affected with pathological bacterial trouble may also be refused admittance. All consignments will be disinfected by exposure to formaldehyd; and the Department of Agriculture of the Union of South Africa reserves the right to sort consignments that appear to contain a large percentage of tubers affected by troubles for which exposure to formaldehyd is not a specific, and to reject the tubers that are found to be thus affected. The fee for disinfecting with formaldehyd gas will be 6*d.* per case, and the fee for sorting will be charged at 2½*d.* per case plus ½*d.* for every 1 per cent. or fraction of 1 per cent. of the tubers which it is found necessary to remove, with a maximum charge of 1s. per case.

---

* This Supplement will be supplied free to subscribers to the *Journal* on written application.

Prohibition of the Importation of Animals from Great Britain into Various Countries.—In consequence of the existence of foot-and-mouth disease in England, several countries have imposed restrictions on the importation of animals from Great Britain.

Argentina.—A decree was issued on 5th July closing Argentine ports to the importation of live stock, other than of the equine species, from the British Isles.

Australia.—A proclamation of 16th May,. 1912, notified that the importation into Australia is prohibited of cattle, sheep, goats, and swine from any area in Great Britain within fifteen miles of any place where foot-and-mouth disease has occurred during the twelve months next preceding the date of proposed shipment.

Sweden.—The Swedish Government has declared Cheshire, Cumberland, Dublin, Lancashire, Northumberland, Somerset, Surrey, and Yorkshire to be infected with foot-and-mouth disease. A note as to the restrictions which result from this declaration will be found in this *Journal* for November, 1911, p. 690.

Uruguay.—A decree was issued on 15th July prohibiting the importation into the Republic of live stock from the United Kingdom. (*Board of Trade Journal,* July 11th, 18th, and 25th, 1912.)

Importation of Hides and Skins into Roumania.—The importation of hides and skins into Roumania from 14th July last is governed by regulations of the Sanitary Department of the Roumanian Ministry of the Interior.

Hides and skins may be imported only in a dry state; salted hides and skins are not admitted from the United Kingdom. Hides and skins may be admitted only through certain frontier stations, where they will be examined by Government veterinary officials and rejected if found to be in an unfit condition. They will also be refused admission if the importer will not bind himself to transport them without delay to their destination.

Consignments of hides and skins must be accompanied by sanitary certificates (with translation into the Roumanian or French language authenticated by a public authority) emanating from the Public Health Department of the place of origin, stating that the hides or skins come from healthy animals, and that the locality whence the hides or skins come is not infected with epizootic diseases such as cattle plague or contagious pleuro-pneumonia. (*Board of Trade Journal,* June 27th, 1912.)

Importation and Sale of Fertilisers in Cape Colony.—Under a Proclamation (No. 65 of 1912), dated April 12th, 1912, no fertiliser may be imported into or sold in the Province of the Cape of Good Hope under the name of "sulphate of potash" or "muriate of potash," unless such fertiliser contain at least 48 per cent. or 44 per cent. of potash respectively.

All fertilisers intended for sale under the names of "sulphate of potash" or "muriate of potash" must be registered in one of two grades, viz.:—"High grade sulphate of potash" or "sulphate of potash," and "high grade muriate of potash" or "muriate of potash."

"High grade sulphate of potash" must contain a minimum of 51 per cent. of potash, and "high grade muriate of potash" must contain a minimum of 60 per cent. of potash.

It will not be lawful to sell the above-mentioned fertilisers under the designation "high grade" unless the containing receptacles are clearly marked with the words "sulphate of potash," "high grade," or "muriate of potash," "high grade," as the case may be. In addition to being so marked, each receptacle must be marked in distinct figures with the actual minimum percentages of pure potash contained in the fertilisers in question. (*Board of Trade Journal*, June 13th, 1912.)

Agricultural Exhibitions Abroad.

Agricultural Exhibition at Khabarovsk.—An Agricultural and Industrial Exhibition will be held at Khabarovsk (Siberia) in July, 1913. Sections of the exhibition will deal with agriculture, live stock, timber, fishing, sporting and hunting, and machinery. (*Board of Trade Journal*, April 25, 1912.)

Agricultural Exhibition at Rostov-on-Don.—H.M. Consul at Rostov-on-Don reports that an agricultural and industrial exhibition will be held there from September 23rd to October 9th, a horse show will be held between September 25th and October 1st, and a cattle and poultry show between October 1st and October 9th.

Agricultural Machinery Abroad.

Demand for Agricultural Machinery in Russia.—H.M. Commercial Attaché at St. Petersburg reports that with a view to decreasing the dependence of Russia on the United States in regard to agricultural machinery, the Russian Board of Agriculture propose to take steps to ascertain prices and conditions of export to Russia of agricultural machinery in Canada, Sweden, Germany, the United Kingdom, and Austria-Hungary, and to purchase the best types for trial in Russia. The sum of £2,100 has been assigned to the Board of Agriculture towards the realisation of these measures.

Bounties are also to be granted to Russian manufacturers of agricultural machinery after 14th January, 1913.

According to a report of the British Vice-Consul at Berdiansk, the imports of agricultural machinery in the first ten months of 1911 for all Russia amounted to 134,500 tons, representing a value of about £4,250,000, of which 49,000 tons, worth about £1,750,000, paid an import duty of 5*s*. per cwt.

The import of duty-free machines goes on increasing yearly, but there is evidence that the number of machines imported and paying duty has reached its highest point and is in some cases diminishing, while the native production of similar machines is increasing largely, the increase from 1910 to 1911 being about 20 per cent. Owing, however, to the failure of the crops in Eastern European Russia and in Siberia, large stocks remain over, so that the production for 1912 has been reduced and several thousand workmen dismissed. This is the first check the trade has received for many years. The values of the principal machines made in 1911 in all Russia were:—

	£
Ploughs and other tillage implements	1,200,000
Seeders—	
Broadcast...	72,000
Radials (drills)	1,200,000
Reapers (mainly hand delivery)	1,365,000
Horse threshers, including gears	890,000

Besides these, hundreds of thousands of winnowers are annually made, the value of which it is impossible to estimate.

The British Vice-Consul at Rostov-on-Don reports that the Imperial Don-Kuban-Ter Agricultural Society have decided to start a permanent exhibition of agricultural machinery and implements at Rostov which is to be open nearly the whole year round.. It will be closed from 14th September to 28th October.

The British Vice-Consul at Kiev reports that there will be a section for agricultural implements at the International Exhibition of Industry, Agriculture, and Art, to be held at Kiev from 27th May to 14th October, 1913. (*Board of Trade Journal*, April 11th, June 20th, July 4th, 11th, and 25th, 1912.)

Agricultural Machinery in Portuguese East Africa.—It is probable that there will be an increased demand for agricultural machinery in Portuguese East Africa. Foreign machinery is admitted duty free, and is therefore not affected, like other classes of goods, by the preference accorded to imports from Portugal. (*Board of Trade Journal*, June 6th, 1912.)

State Manufacture of Agricultural Implements in Western Australia.—The State Government of Western Australia have decided to undertake the manufacture of agricultural implements and machinery. (*Board of Trade Journal*, April 25, 1912.)

Artificial Manures Abroad.

Artificial Manures in Russia.—The imports of fertilisers into Russia from the United Kingdom in 1911 showed a decided increase over 1910. Special mention may be made of the growth in the importation of phosphates, of which 75 per cent. comes from the United Kingdom, and in the amount of sulphate of soda received from the United Kingdom, which was double that of the previous year. This trade is likely to improve steadily by reason of the constantly increasing demand caused by the development of Finnish agriculture and allied trades, such as the dairy industry.

According to a report by H.M. Consul-General at Odessa, the wonderful fertility of the black earth soil has begun to show signs of deterioration, and it is clear that if the Russian crop yield is to be brought up to Western European standards, or indeed kept from shrinking away, greater use must be made of phosphorites, phosphates, potash salts, basic slag, nitrate of soda, and sulphate of ammonia.

Phosphates, &c.—Superphosphates, and the material for their production, come mostly from abroad. Iron pyrites is scarcely found in Russia; phosphorites are found in many places in Podolia and in Central Russia, but are often of poor quality. Pulverised phosphorites are useful only in special soils or under special conditions.

Slag.—Basic slag is produced by only one factory, which makes about 16,000 tons a year. The import into Russia was 88,000 tons in 1908, and 141,000 tons in 1911.

Nitrate of Soda.—In Russia no deposits are known where nitrate of soda can be mined profitably; the whole supply is imported, mostly by way of Hamburg.

Sulphate of Ammonia.—A certain quantity of sulphate of ammonia is produced as a by-product at gasworks, &c., but it is, so far, seldom used as a fertiliser. With a reduced price its use would increase. The coke ovens in the Donetz basin are shortly expected to produce much larger quantities.

Potash Salts.—Potash salts are imported, as in Russia they are not found in paying quantities. Artificial fertilisers, brought from long distances, and passing through many hands, cannot be cheap in Russia. There is much to be done, especially in the way of cheapening the transport, before they can come into general use. (*Board of Trade Journal,* June 13th and July 11th, 1912.)

Consumption of Artificial Manures in Spain.—A recent report of the Spanish *Direccion General de Agricultura* calls attention to the increasing use of artificial manures in Spain, which is in great part due to the work of agricultural colleges in demonstrating the benefits to be derived from their use. The total consumption of artificial manures in 1911 was estimated at 581,000 metric tons. The imports in 1910 were:—Natural phosphates of lime, 107,000 tons; superphosphates and basic slag, 237,000 tons; nitrate of soda, 33,000 tons; potash salts, sulphates of ammonia and iron, 92,000 tons; and guano and other organic manures, 4,000 tons. (*Bull. Bur. Agric. Int. and Pl. Dis.,* May, 1912.)

Of late a great impetus has been given to the manufacture of superphosphate of lime in Valencia. Already three factories exist, and two more are in course of erection; when completed it is estimated that there will be a total annual production of some 120,000 tons. This change in the superphosphate business will necessarily affect the demand for the imported article. (*Board of Trade Journal,* June 6th, 1912.)

Demand for Manures in Japan.—The following information is from the report by H.M. Commercial Attaché at Yokohama (Mr. E. F. Crowe) on the trade of Japan in 1911:—

The fertiliser business in Japan is one of great importance, the value of the imports last year amounting to £5,248,700, or over 10 per cent. of the total value of imports. The increase over 1910 amounted to no less than £1,379,300.

The advance in sulphate of ammonia was large, being £155,300, but it was far surpassed by the very big increase in bean cake of £849,600, viz., from £1,735,400 to £2,585,000, this latter figure being the record up to the present. There were also considerable gains in phosphate rock (£155,000), nitrate of soda (£135,900), rape-seed and cottonseed cake, fish cake and fish guano, while the only items to show decreases were dried blood, animal bones, and superphosphates.

It is thought by experts that there is bound to be a continued increase in the imports of nitrogenous materials in the future, as not only are the home supplies not expanding at the same pace as the demand, but some of them, notably those obtained from rape seed and fish, are actually decreasing. Both sulphate of ammonia and nitrate of soda are likely to share in this increase. (*Board of Trade Journal,* May 30, 1912.)

Notes on Agriculture Abroad.

Agricultural Development in Brazil.—By Article 9 of a Federal Decree (No. 2543A) of January 5th, 1912, the Brazilian Government intend to develop agriculture in the valley of the Amazon by means of the establishment of cattle runs, the breeding of stock, the cultivation of cereals, the preparation of jerked beef, and the establishment of factories, mills, &c., for certain products.

It is proposed to make concessions to certain agricultural or breeding undertakings to be established in the Amazon valley in the form of (*a*) exemption of import duties on all machinery and materials required; (*b*) premiums on land sown with foodstuffs; and (*c*) a premium payable on every 500 tons of preserved milk, meat, &c., produced within the first five years. (*Board of Trade Journal,* April 4th, 1912.)

Budget of the French Ministry for Agriculture for 1912.—The sum of £2,167,610 is provided in the French Budget of 1912 for expenditure on agriculture, or £16,363 more than in 1911. The main items are given in *F.O. Reports, Annual Series,* No. 4854, as follows:—

	£
Grants in aid to farmers and subventions to agriculture... ...	103,000
Bounties for the cultivation of silkworms, hemp, and olives...	371,000
Indemnities for the destruction of diseased animals	64,000
Stud farms	283,000
Encouragement of horse-breeding	53,000
Preservation of forests, dunes, &c.	190,000
Expenditure on forestry	239,000

Agricultural Expansion in South Africa.—The agricultural statistics of the Transvaal for 1911 show the growth in the agricultural industry which is taking place throughout South Africa as a whole. Since 1909 the total head of stock (excluding pigs) in the Colony has increased by 15 per cent. Cattle, horses, and donkeys show the most remarkable increases, varying from 30 per cent. to nearly 50 per cent. Figures for pigs can be obtained only for the two years 1910 and 1911, during which, however, their number increased from 172,000 to 212,000. Farm and agricultural produce results are equally satisfactory. There were large increases, as compared with 1910, in the production of wool, wheat, oats, oat hay, and potatoes; and the same is true of maize, though the export of this commodity showed a slight decline. (*Board of Trade Journal,* March 7th, 1912.)

Market for Tinned Butter in Venezuela.—From information furnished to the Board of Trade by the British Vice-Consul at Caracas, it appears possible that Venezuela might offer to butter-makers in this country a favourable market for the disposal of their produce.

The greater part of the butter used in the country is imported, the lower qualities for cooking purposes chiefly from the United States, and the better-class butters for table use almost exclusively from Denmark, though a certain amount also comes from France. The butter is packed in tins of 28 lb., 14 lb., 400 grammes, 200 grammes, and, more rarely, 460 grammes and 230 grammes capacity, and the price realised in Denmark is approximately 1*s.* 5*d.* to 1*s.* 8*d.* per lb. of 460 grammes. The import duty is about 4½*d.* per kilogramme, or 2*d.* per lb. gross weight.

Butter for the Venezuelan market should be of a rather deep yellow colour, and should not lose this colour on being kept for a year. It should also not be too salt, unless intended for the Ciudad Bolivar market, where a salter butter appears to be preferred.

The Board understand that orders are usually given about the month of April for the whole year, the butter being shipped as required.

Dutch Phytopathological Service for the Exportation of Plants.—A Royal Decree of May 24th, 1912, of the Netherlands modifies the regulations for the general Phytopathological Service of the country, and provides for the establishment of a special Phytopathological Service for the promotion of the exportation of plants and parts of plants which may be regarded as being free from plant diseases and injurious insects.

The duties of this special service consist in the examination, on being requested to do so, of—

(*a*) farms and establishments of which the products are destined for export.

(*b*) of plants or parts of plants destined for export.

The service will also issue certificates to accompany consignments to foreign countries. Charges will be made both in connection with the examination of premises and plants, and the issue of certificates.

Notes on the Weather in July.

During the *first* week (June 30th to July 6th) the weather was extremely unsettled, with thunderstorms in many parts of England. Temperature was below the average in all districts except Scotland N. Over eastern, central, and southern England the rainfall was in excess of the normal, but elsewhere there was a general deficiency. Bright sunshine was below the average, especially over eastern, central, and southern England.

The conditions remained unsettled during the *second* week, although there were several days with little or no rain in the eastern and southern parts of Great Britain. Temperature was "moderate" in England S.W. and Scotland, but elsewhere it was "unusual." Rainfall was "heavy" in Scotland W., but elsewhere it was moderate, except in England S. and S.E., and the Midland Counties, where it was "light." Bright sunshine was under the average except in England E.

In the *third* week the weather was fair and dry throughout the north-west of England and over a large area in Scotland, but towards the end of the week the conditions again became unsettled over England generally, and rain fell in most places. Temperature was "moderate" in Scotland N. and E. and England N.E., but elsewhere it was "unusual." Rainfall was light or very light in all districts except England E. and N.E. Bright sunshine exceeded the average except in Scotland E. and England N.E.

The fair and dry conditions continued in Scotland and England S. and E. until the middle of the *fourth* week, when the weather again became unsettled and rainy. Temperature was slightly above the average over the greater part of England, and in Scotland N. and W., and below it elsewhere. Rainfall was deficient in England S.E. and Scotland N. and W., but in all other districts it was in excess of the average. Bright sunshine was everywhere below the average.

Agricultural Conditions in Great Britain on August 1st.

In the Reports furnished by the Crop Reporters of the Board on the agricultural conditions in England and Wales on August 1st general reference is made to the wet and stormy weather during July over the greater part of the country, which seriously delayed the hay harvest, and laid the corn in many counties. Warmer weather and sunshine are now much desired for all crops, as well as for the corn harvest, which had generally started in the southern half of the country. The estimates for the yield of wheat have undergone a slight reduction on the month, but not amounting to more than one point, the present figure being about 2 per cent. below average. Barley is reported as somewhat improved throughout the country, and now promises to be the best of the cereals. Oats still remains a very poor crop, as indicated in last month's report, and the yield is estimated to be nearly 10 per cent. short of an average for England and Wales as a whole. Satisfactory yields of oats are being obtained only in the extreme north and south-west and in central Wales. Beans have not done well during July owing to lack of sunshine, and the estimates for this crop have been lowered. Peas have apparently suffered from the wet weather to an even greater extent.

The excessive wet weather has proved detrimental to the potato crop, especially in Lincolnshire, where disease is widespread. In other parts of the country the attacks are not as yet so severe as in Lincolnshire, but sunshine is badly needed to save the crop from further injury. Estimates of the yield show a reduction of 2 per cent., but an average yield was considered to be probable for the country as a whole.

The wet weather has proved, on the whole, beneficial to the root crops. The mangold crop has grown well, as a rule, and its prospects have improved, but warm weather would further help the crop. The yield is expected to be 4 per cent. above an average, an improvement of 3 per cent. since July 1st. Turnips and swedes are generally a full crop, and have made fairly vigorous growth; with drier weather the outlook for this crop would be very promising. Many reporters mention that the weather has been too wet to enable progress to be made with hoeing.

Except in the south-eastern counties the hay harvest has been much interfered with by the stormy weather. Some early crops of rotation hay were well secured, but the bulk of this crop and also the meadow hay have been damaged by the rains; at the date of the reports a good deal of meadow hay was lying ungathered and some fields were still uncut. The yield of "seeds" hay is better than usual in the northern counties, and about average in Wales, but elsewhere it is very light; for the country, as a whole, the crop is now estimated at 8 per cent. short of an average. The meadow hay was increased in bulk by the rains, and, except in the eastern and south-eastern counties, has proved rather above average.

The reports received concerning the condition of the hop crop uniformly state that attacks of vermin have been more persistent than usual this season, and consequently more frequent washing has been necessary. The efforts of the growers had, however, generally proved successful, and the hops were healthy and fairly clean at the end of July. Only slight attacks of mould and red spider had appeared. The hops tended to be somewhat slack in the bine, but as a rule were promising satisfactorily, though warmer nights were desired.

Orchards are generally looking healthy. Apples are a small crop in the west of England, but about average in Kent; pears are about an average in the west, but may give fairly large crops in Kent; plums are short in most parts of the country.

The pastures are everywhere full of keep after the rains, and stock as a rule have done well, but in some parts of the country the wet weather has been detrimental to sheep.

Summarising the reports and representing an average crop by 100, the appearance of the crops on August 1st indicates yields for England and Wales which may be represented by the following percentages:—Wheat, 98; barley, 102; oats, 91; beans, 97; peas, 99; potatoes, 100; mangold, 104; "seeds" hay, 92; meadow hay, 102; hops, 100.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for July, 1912, issued by the International Institute of Agriculture, states that the wet weather experienced in many parts of Europe during June has had a fairly favourable influence on the crops, although in some localities the rain lodged the wheat, and attacks of rust are reported. Generally, corn crops are expected to be satisfactory.

The condition of the crops in *Germany* is estimated at:—Winter wheat, 2·3; spring wheat, 2·2; winter rye, 2·4; spring rye, 2·3; spring barley, 2·1; oats, 2·5 (1=very good; 2=good; 3=average; 4=bad; 5=very bad). By the same scale *Austria's* crops are put at 2·1 for wheat, rye, and maize, and 2·3 for barley and oats. In *Belgium* the cold weather at the commencement of the month unfavourably influenced young crops. Although corn crops are improving in *Denmark*, the yield of wheat is still expected to be below the normal. *Spain* has again suffered from unfavourable weather. In *France* (using the scale 100=very good; 80=good; 60=fairly good; 50=passable; 30=mediocre; and 20=bad) the crops are estimated as: Wheat, 71; rye and barley, 76; and oats, 75. *Hungary* reports that the wheat prospects, although generally favourable, have been lowered by the abundant rain lodging the crop on the richer soils and by attacks of rust; in the south more serious damage has arisen from the disease *Ophiobolus graminis*. Southern *Italy* did not share in the rain, and wheat and oats will probably give bad yields on account of drought. Excellent cereal crops are anticipated in *Norway*. On the whole, *Russia's* winter crops are satisfactory and even good.

The cold weather has delayed spring sowing, but the seedlings are developing well. *Sweden* and *Switzerland* both render favourable reports.

Canada has suffered from unfavourable weather. Wet has retarded growth in the East, whereas in the North-west trouble arose from heat and drought, but rain has now fallen. Prospects are generally favourable. Taking an average yield at 100, the conditions may be expressed as 86 for winter and 102 for spring wheat; 101 for rye; 99 for barley; 96 for oats.

Forecasts of Total Production.—For certain countries in the Northern Hemisphere the Institute gives estimates of the total production:—

Wheat.—The countries given furnished about a half of the world's wheat supply in 1911, and are Belgium, Spain, England and Wales, Hungary, Italy, Luxembourg, Switzerland, United States, India, Japan, and Tunis. Together they are expected to produce 197,128,000 qr., as against 204,867,000 qr. in 1911, *i.e.*, a reduction of 3·8 per cent., the principal decreases being 2,232,000 qr. in Italy, 1,059,000 qr. in India, and 354,000 qr. in Hungary.

Rye.—The forecasts comprise Belgium, Prussia, Spain, Hungary, Italy, Luxembourg, Switzerland, and Algeria, which produced about a quarter of the world's crop in 1911, and are this year estimated to yield 53,761,000 qr., as against 51,702,000 qr. last year, *i.e.*, an increase of 4 per cent., the most substantial gains being 1,668,000 qr. in Prussia and 671,000 qr. in Hungary.

Barley.—Belgium, Spain, England and Wales, Hungary, Italy, Luxembourg, Switzerland, United States, Japan, and Tunis were responsible for about a third of last year's world production, and are together expected to contribute 58,343,000 qr. in 1912, as against 58,818,000 qr. in 1911, or approximately a decrease of 0·8 per cent., the principal variations being an increase of 4,050,000 qr. in the United States and a decrease of 3,381,000 qr. in Spain.

Oats.—The countries included, Belgium, Spain, England and Wales, Hungary, Italy, Luxembourg, Switzerland, United States, Algeria, and Tunis, were responsible for 127,993,000 qr. in 1911 (a quarter of the world's supply). This year they are forecasted to yield an increase of 14·2 per cent., making the crop 146,202,000 qr. The net increase is largely owing to the excellent average yield expected from the United States, although the area is much the same as in 1911; the production is put at 22,220,000 qr. more.

Southern Hemisphere.—The sowing of autumn cereals is reported as practically completed in Australia and Chili. In both countries germination is good. The weather in New Zealand is unfavourable for the sowing of winter wheat, which should now be in full swing.

Sugar Beet.—In Austria this crop, in spite of continued damage by insect pests and weeds, is well over average. Beet is also doing well in Belgium (yield of 5 per cent. above average is expected), France, Hungary, and Italy.

The Institute states that the figures for the 1911 crop of sugar beet in *Servia*, as given in the June Bulletin, and quoted in the Board's July *Journal*, were incorrect, and should be:—Area, 11,263 acres in 1911 and 7,420 acres in 1910; production, 90,227 tons in 1911 and 62,459 tons in 1910—an improvement of 44·5 per cent.

Sweden.—H.M. Consul at Stockholm, in a report dated July 9th, stated that although rather early to estimate very accurately, this season would be a good one for agriculturists. The hay crop was generally expected to be very satisfactory, in some districts even excellent. The southern part of the country had been visited by heavy rainfalls, but this did not appear to have caused any deterioration of the crops by excess, and in many parts was very beneficial. Rye, wheat, oats, and barley were about average, and in some districts anticipated as good. Prospects were better for pears than for apples.

Germany.—The following table gives the preliminary official estimate of the acreage of the principal crops in Germany:—

Crop.	1911–12.	1910–11.	Difference per cent. in 1911-12 from 1910–11.
	Acres.	Acres.	
Winter Wheat	4,273,382	4,325,563	– 1·2
Spring „	482,878	550,706	– 12·3
Winter Rye...	15,216,996	14,858,972	+ 2·4
Spring „	265,350	296,237	– 10·4
Spring Barley	3,926,292	3,915,456	+ 0·3
Oats	10,834,739	10,689,036	+ 1·4
Potatoes	8,253,431	8,204,061	+ 0·6
Clover...	4,269,160	4,966,688	– 14·0
Lucerne	607,657	598,703	+ 1·5
Hops	66,720	65,909	+ 1·2
Rape Seed	82,777	117,992	– 29·8
Permanent Grass for Hay... ...	14,622,924	14,650,059	– 0·2

Hungary.—According to the report of the Minister of Agriculture of July 22nd, the yield of wheat is estimated at 21,307,200 qr.; barley at 7,991,500 qr.; oats at 8,497,200 qr.; and rye at 6,062,800 qr., as compared with wheat 21,913,000 qr.; barley 9,218,000 qr.; oats 10,238,000 qr.; and rye 6,336,000 qr. in 1911. (*Dornbusch,* July 30th.)

Canada.—According to reports compiled by the Census and Statistics Office at Ottawa to July 17th, the weather of June in the maritime provinces and generally throughout eastern Canada, continued cold and wet, and growth was therefore slow. In the north-west provinces the weather of June was hot and dry, and rain was badly needed at the beginning of July. Rains have since fallen, however, and conditions have improved. Prospects for spring-sown crops are generally favourable. The revised estimate obtained at the end of June gives the total area under wheat this year as 10,047,300 acres, compared with 10,377,159 acres in 1911. The area sown to oats is estimated at 9,494,600 acres, compared with 9,233,550 acres in 1911, and to barley 1,449,200 acres, as against 1,403,969 acres in 1911.

United States.—Consular reports of June 27th and July 4th state that large fruit harvests are to be expected in the west this year. In the State of Washington, in the Jahima Valley district, alone, it is estimated that the value of the entire fruit crop will amount to nearly £1,400,000, as compared with £700,000 last year. This year's apple crop in Montana promises to be a record one. The plum crop in Oregon, however, will be very light, the average yield being estimated at one-third of a normal crop.

The Crop Reporting Board of the Bureau of Statistics, in a report dated August 9th, estimates the production of winter wheat at 390,000,000 bushels, and of spring wheat at 290,000,000 bushels, compared with 430,656,000 bushels and 190,682,000 bushels in 1911. The average yield per acre for the whole wheat crop is given as 15·1 bushels, compared with 12·5 bushels last year. The oat crop is expected to yield

1,207,000,000 bushels, with a yield per acre of 31·3 bushels, as against 922,298,000 bushels and 24·4 bushels in 1911. The production of barley is placed at 202,000,000 bushels, that of rye at 35,000,000 bushels, and that of maize at 2,811,000,000 bushels, as compared with 160,000,000 bushels, 17,500,000 bushels, and 2,531,488,000 bushels, respectively, last year. (*Broomhall's Corn Trade News*, August 9th, 1912.)

Norway.—H.M. Consul at Christiania, in a report dated July 3rd, stated that, according to official information, the hay crops in Norway, south of the Trondhjem district, promised to be considerably above the average. The potato crop also promised well throughout the country. Reports of the probable harvest of apples and pears were somewhat discouraging, but for cherries, plums, and bush fruits the prospects were considerably better.

Hop Prospects.—Messrs. John Barth and Son, of Nuremberg, in a report dated July 17th, state that the present position of the hop crop is satisfactory; the dry weather in the spring, however, very much retarded the growth, and although subsequent abundant rain has been very helpful, many plants, though perfectly sound, are weaker in development than in former years.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on August 1st, 1912, certain diseases of animals existed in the countries specified:—

Austria (for the period July 17th—24th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 290 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period June 1st—16th).

Anthrax, Blackleg, Foot-and-Mouth Disease (7 "foyers" in 6 "communes"), Glanders and Farcy, Rabies.

Bulgaria (for the period July 6th—14th).

Glanders and Farcy, Rabies, Sheep-pox, Swine Fever.

Denmark (month of May).

Anthrax, Foot-and-Mouth Disease (50 cases), Swine Erysipelas.

France (month of June).

Anthrax, Blackleg, Foot-and-Mouth Disease (1,347 "étables" in 393 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period July 1st—15th).

Foot-and-Mouth Disease (242 infected places in 49 parishes), Glanders and Farcy, Swine Fever.

Holland (Month of June).

Anthrax, Foot-and-Mouth Disease (12 outbreaks in 5 provinces), Foot-rot, Glanders and Farcy.

Hungary (for the period July 3rd—10th).

Anthrax, Foot-and-Mouth Disease (total of 186 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period June 24th—30th).

Anthrax, Foot-and-Mouth Disease (42 new cases entailing 1,928 animals), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period May 1st—15th).
Foot-and-Mouth Disease (16 "étables" infected in 8 "communes").

Norway (month of June).
Anthrax, Blackleg, Swine Fever.

Roumania (for the period July 5th—13th).
Anthrax, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of March).
Anthrax, Foot-and-Mouth Disease (1,343 animals in 57 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period July 6th—13th).
Anthrax, Sheep-pox, Swine Fever.

Spain (month of May).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (90,459 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of June).
Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (for the period July 15th—24th).
Anthrax, Blackleg, Foot-and-Mouth Disease (125 "étables" and "pâturages" entailing 8,616 animals, of which 29 "étables" and "pâturages" were declared infected during the period), Glanders and Farcy, Swine Fever.

Agricultural Labour in England during July.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report based on returns from correspondents in various districts on the demand for agricultural labour in July:—

Outdoor agricultural employment was somewhat irregular during July on account of rain in many districts in the Northern, Midland, and South-Western counties, and men outside the regular farm staff lost time in consequence. There was otherwise a fairly good demand for such men, principally for haymaking and hoeing, and more men could have been employed if available in several of the districts reported on. There was still some scarcity of men for permanent situations in parts of the Southern and South-Western counties.

Northern Counties.—Rain caused a good deal of interruption to outdoor employment in these counties during July, and extra labourers suffered loss of time in consequence. When fine there was a good demand for these men in most districts for haymaking and cleaning the root crops, the supply being insufficient for the demand in parts of the Clitheroe (*Lancashire*), and Leyburn, Northallerton, and Pickering (*Yorkshire*) Rural Districts.

Midland Counties.—Extra labourers were in fairly good demand for haymaking and hoeing and singling roots until towards the end of the month, when wet weather interfered with employment in many districts, particularly in the more northern and western counties. The supply of men was usually sufficient, but some scarcity was reported in parts of the Tarvin (*Cheshire*), Cannock, Leek, and Stone (*Stafford-*

shire), Oswestry (*Shropshire*), Banbury (*Oxfordshire*), and Buntingford (*Hertfordshire*) Rural Districts.

Eastern Counties.—Employment was for the most part regular throughout the month in these counties, and the supply of extra labourers was generally about balanced by the demand, which was especially good in the last week of the month in some of the more southern districts on account of the corn harvest having begun. Some scarcity of such men was reported in parts of the Erpingham and Swaffham (*Norfolk*) Rural Districts, while a surplus was reported in the Henstead Rural District in the same county.

Southern and South-Western Counties.—Haymaking, hoeing roots, and, in certain districts at the end of the month, the corn harvest, provided a good deal of employment for extra labourers in these counties, although this was somewhat irregular in some of the western districts on account of rain. The supply of extra men was generally about equal to the demand; a scarcity of such men was, however, reported in the Godstone (*Surrey*), Andover (*Hampshire*), and Axminster (*Devon*) Rural Districts, as against a surplus in the Blean (*Kent*) and Guildford (*Surrey*) Rural Districts. A scarcity of men for permanent situations was reported in the Godstone (*Surrey*), Chailey and Petworth (*Sussex*), Axbridge and Williton (*Somerset*), Dursley, Northleach, Stow-on-the-Wold, Thornbury, and Winchcombe (*Gloucestershire*), Axminster (*Devon*), and West Penwith (*Cornwall*) Rural Districts.

THE CORN MARKETS IN JULY.

C. KAINS-JACKSON.

Wheat.—Throughout the month the price of English wheat at Mark Lane clung closely to an average of forty shillings per 480 lb., or 42*s.* for the East Anglian quarter of 504 lb., the usual unit of London transactions in home-grown wheat. The range in the price of Canadian wheat has been as wide as that of home produce has been restricted. No. 1, if obtainable at all, has commanded 43*s.* per 480 lb., while No. 2 has made 41*s.* 6*d.* to 42*s.* 3*d.*, No. 3 40*s.* to 40*s.* 6*d.*, No. 4 35*s.* 6*d.* to 36*s.* 6*d.*, No. 5 31*s.* to 32*s.*, and No. 6 27*s.* to 28*s.* The sorts most in evidence have been Nos. 3 and 4, and in these a very fair business has passed. Indian has inclined to favour buyers a little; the dominant prices per 492 lb. (496 lb. natural weight and 4 lb. allowed for tare) have been 39*s.* for white, and 38*s.* 6*d.* for red. South Russian has kept well above forty shillings, and is expected to remain scarce till there are new crop deliveries, which will not be just yet. Australian at 42*s.* to 43*s.* must be regarded as dear on milling value as compared with other sorts of wheat, but it has been in very firm hands, and has held its own. Argentine presents a variety of types, but may be averaged at about 39*s.* per 480 lb. ex warehouse. At Liverpool the range is given as from 6*s.* 11*d.* to 7*s.* 5*d.* per cental, the Mersey apparently taking some inferior wheat which has not come to London. The wheat markets as a whole have hardened on the year, and trade has been of a healthy character. The total imports and deliveries for eleven months of the cereal year are fully equal to, or slightly exceed, those the like period in last campaign. Yet both home-grown and imported sorts of wheat are decidedly dearer on the twelvemonth. Stocks in the fifteen chief ports are 2,020,000 qrs. against 1,925,000 qrs., so that no rise in the actual consumption of breadstuffs is indicated. In British wheat the advance is largely assignable to superior quality, but this will not apply to the better prices obtained for imports. During July the situation has in one respect become decidedly adverse to holders, for on the last day of the month there were 3,330,000 qrs. on passage, against 2,850,000 qrs. a year before, and this, with harvest in full progress south of the Thames, was sufficient to cause August to open with sellers forward at some decline on almost every sort of wheat except Russian. The United States hold two million quarters less old wheat than they did a year back, but the new crop is considered a little larger than that of 1911, and Canada reports larger stores of old wheat than on July 31st, 1911. Little practical support, therefore, has been derived from the comparative exhaustion of old wheat reserves in the United States. Shipments for July were 903,000 qrs. from North America, 1,293,000 from South America, 1,041,000 from Russia, 452,000 from Europe S.E., 1,297,000 from India, and 161,000 from Australia. North and South America having done much more than in July, 1911, the falling off in Russian exports has been balanced. Indian shipments have exceeded, and those of Australia fallen below the average, but these occurrences were fully discounted by the respective crop reports with the effect of which they are in complete agreement. Speculative business has been fairly active in red American winter wheat for October and November delivery at 7*s.* 3*d.* per cental to Liverpool, and 35*s.* per 480 lb. to London.

Flour.—The month's imports having been much below the average, holders of foreign kinds have shown great steadiness. There are, however, 216,000 sacks on passage, and prices for September delivery are lower for all kinds. The London makes are 6*d.* to 1*s.* lower on the month; this is partly due to the disappearance of all difficulties in securing delivery. Town Households closed at 28*s.* 6*d.* for cash ex-mill, 29*s.* with a month's credit, and 30*s.* old-fashioned full credit and delivery terms. Whites, as usual, were 3*s.* above Town Households in all positions, and No. 2 1*s.* 6*d.* below Households. For Standard or 80 per cent. flour a like price with that of Town Households tends to be asked, while the best American wheat ground in one of the great London mills is most frequently on a parity with Town Whites. No probable parities are, however, obtainable with respect to country flour, which varies in price with the milling value of each season's home-grown wheat. To-day the terms quoted for flour fresh up from East Anglian mills to the London station are 28*s.* 9*d.* to 29*s.* 9*d.* for country patents, 27*s.* 9*d.* to 28*s.* 9*d.* for straight run, and 26*s.* 9*d.* to 27*s.* 9*d.* for roller whites. North America in July shipped only 252,000 sacks.

Barley.—New winter corn appeared at Dorchester market on the 20th, and at Mark Lane on the 29th was in sufficient evidence for an opening price to be quotable. The best lots made 35*s.*, secondary 33*s.*, and the quality was good. Barley of the old crop was offered in London at 36*s.* per 448 lb. for a bold type of rather thick-skinned "poultry" grain. Buyers offered 34*s.* Extreme scarcity of old barley has marked all the exchanges since midsummer. Imported barley is 1*s*. cheaper on the month for Indian and Persian, and 6*d*. lower for Russian, but the latter is in poor supply on spot. Shipments for July were 253,000 qrs. from Russia, 610,000 qrs. from India, and 24,000 qrs. from California. Trade advices credited California with a good crop of brewing barley, and purchases for October shipment have been effected at the Baltic at 35*s*. per 448 lb. A few "parcels" for August shipment have fetched 36*s*., a shilling premium on rapid threshing and shipping. The new Russian crop is pressed on sale for October shipment at 22*s*. per 400 lb. There are 385,000 qrs. of barley on passage, a larger proportion than usual of which is of low grade. The large Indian shipments were a leading feature of the month.

Oats.—Winter oats were offered at Chichester on the 24th, and fetched 23*s*. to 23*s*. 6*d*. At Mark Lane on the 29th, winter oats were in fair quantity, and made 21*s*. 6*d*. to 22*s*. per 336 lb. Old oats continued to make 28*s*. per 336 lb. up to the end of the month. Imported kinds which on June 30th realised 19*s*. cash ex warehouse for Argentine were not more than 6*d*. cheaper after a month's heavy arrivals of that kind. A good sale has occurred, and stocks do not remain long in hand. The price of 15*s*. 9*d*. has been accepted for September delivery, but many consider this a depression not likely to rule for long. The Argentine sellers are undoubtedly apprehensive of the depression which will be caused to inferior oats by their own large exports of cheap maize. The new crop in Russia is generally regarded as decidedly larger than that of 1911, but it is not expected to get into motion in time to affect British markets for some weeks to come. July shipments were 295,000 qrs. from Canada, 639,000 qrs. from Argentina, 336,000 qrs. from Russia, and 10,000 qrs. from New Zealand. The Canadian are fetching 23*s*. to 23*s*. 6*d*. for best grade, the Russian 21*s*. for Black Libau, 22*s*. 6*d*. for White Odessa, and the New Zealand 23*s*. 6*d*. to 24*s*. There are now 460,000 qrs. of oats on passage.

Maize.—The price for October delivery of Argentine has remained steady at 23*s*. to 24*s*. per qr.; from that low price there has been no further decline, but the purchases have been heavy, and the whole position of the trade in dry feeding stuffs is being profoundly modified, not only by the very modest price accepted by Argentina, but by the ability to secure definite contracts for autumn delivery of as much grain as the British ports care to take. Russia, Roumania, the Austro-Hungarian Empire, and the United States are all credited at Mark Lane with fair to good crop promise, so that round and flat corn supplies are expected to take up the running as soon as the shipments of yellow begin to flag. July shipments were 2,525,000 qrs. from South America, 244,000 qrs. from Russia, and 422,000 qrs. from Europe S.E. There are 1,200,000 qrs. on passage to the U.K., mainly from Argentina.

Oilseeds.—The market for linseed shows little change; at 60*s*. per qr. there is a fair sale. Shipments were 288,000 qrs. from South America, and 269,000 qrs. from India. Cottonseed is a little easier on the month, as crop prospects in Egypt have improved. Sunflowerseed gains ground as an oilseed; at 14*s*. 6*d*. per cwt. it is reckoned good value. English rapeseed at 88*s* per 424 lb. for best has had a rather good sale. Ordinary Indian (416 lb. to the quarter) may be had for about 50*s*.

Various.—Canary seed, after advancing to 64*s.* per 464 lb., has fallen to 60*s.* and thereat is firm. Beet sugar has recovered from 11*s.* to 12*s.* 3*d.* per cwt. There are no material changes in beans, peas, or buckwheat, or in the prices asked for by-products of the mill.

THE LIVE AND DEAD MEAT TRADE IN JULY.

A. T. MATTHEWS.

Fat Cattle.—The markets of July have been much disorganised by the outbreak of disease amongst cattle, and several of the largest and most important were closed, including London, Liverpool, Preston, and Newcastle. That this fact had an adverse effect on average prices may be taken for granted, since prices declined during the weeks in which markets were closed, and immediately recovered when they were re-opened. The weather, too, was against the trade at times, being hot and close, and, taking these considerations into account, the smallness of the decline in values points both to a demand fully equal to supply, and to the strong position of holders.

The following are the average prices for the month:—Shorthorns, 9*s.* 5*d.* and 8*s.* 5*d.* per 14 lb. for first and second quality respectively, against 9*s.* 6*d.* and 8*s.* 6*d.* in June; Herefords, 9*s.* 8*d.* and 8*s.* 10*d.*, against 9*s.* 9*d.* and 8*s.* 8*d.*; Devons, 9*s.* 6*d.* and 8*s.* 6*d.*, against 9*s.* 4*d.* and 8*s.* 5*d.*; Polled Scots, 9*s.* 8*d.* and 9*s.* 5*d.*, against 9*s.* 10*d.* and 9*s.* 3*d.* per stone. Welsh Runts were not forward in quotable numbers during the first four weeks of the month. The trade in Scotland continued remarkably good, and no stoppage of markets took place. In the week ending July 24th Shorthorns averaged 46*s.* 2*d.* per live cwt. for best quality, against 41*s.* 10*d.* in the four English markets quoting by live weight.

The rains of June refreshed the pastures, and cattle generally have come forward in very good condition. There have been no forced sales owing to scarcity of grass, such as depressed the trade during last summer's drought, and prices are now about 1*s.* 5*d.* per stone higher than at the same period of last year.

Veal Calves.—There was no notable feature in the fat calf trade. The averages for the month were again 8¼*d.* and 7¼*d.* per lb. Prices vary widely at different markets, and in the week ending July 24th they ranged from 7½*d.* to 9*d.* per lb.

Fat Sheep.—Trade in fat sheep was remarkably steady, and the average prices in about twenty English markets work out almost exactly the same as in June. These were 8¾*d.*, 7¾*d.*, and 6¼*d.* for the three qualities of Downs, and 8½*d.*, 7½*d.*, and 6*d.* for Longwools. There was less difference than usual in the value of the sheep classed as "Downs" and that of Longwools. There is generally a margin of ½*d.* per lb. between them, but it was only ¼*d.* during the past month.

A considerable number of sheep were sold in London during the two weeks when the Islington market was closed, which escaped quotation, having been sold privately at the stations. These probably numbered about 5,000. Much business must also have been done away from market in many districts, so that official information has been necessarily less complete than usual, but the advance in some cases of nearly ½*d.* per lb. on the reopening of markets, and the small supplies at many of them, encourage the opinion that no serious reduction in values is at present in sight.

Fat Lambs.—There has been a fairly good demand for small, choice lambs, but these are now getting scarce, most of those classed as first quality in the greater markets being Scotch. The general averages in forty British markets were 9¾*d.* and 8¾*d.* per lb. Ten of the above markets were in Scotland, and in them the average in the fourth week was 10¼*d.* In the week ending July 24th the average for second quality lambs was only 8¾*d.*, or slightly less than the value of prime Down mutton. There is no doubt whatever that serious sacrifices are being made by the sale of lambs that would certainly realise much more as stores as soon as the turnips are ready.

Fat Pigs.—Bacon pigs continue to be offered in about thirty British markets, and during July the trade remained steady. Averages were 7*s.* 2*d.* and 6*s.* 7*d.* per stone, against 7*s.* 2*d.* and 6*s.* 6*d.* in June, and 6*s.* 3*d.* and 5*s.* 8*d.* at the beginning of January. Porkers are scarce and in good request up to a moderate limit.

Carcass Beef—British.—Trade for home-killed beef in the London Central Market was fluctuating and irregular, owing to sudden changes of weather and variation of supplies. Beginning at the June level there was a heavy fall in the third week, which was more than recovered in the fourth, when Scotch short sides touched 6*s.* per stone or 9*d.* per lb. The averages for the month were: Scotch short sides, 5*s.* 7*d.* and 5*s.* 4*d.* per 8-lb. stone for first and second quality respectively; long sides, 5*s.* 2*d.* and 5*s.*; and English, 4*s.* 8*d.* and 4*s.* 6*d.* Supplies of English were small, and in the fourth week there was none at all of first quality. Scotch beef fetched 1*d.* per stone more than in June, and English 2*d.* less.

Port Killed Beef.—Deptford sides of American beef were not much in evidence at any time, and on some days there were none at all on offer. The average prices were about 4*s.* 9*d.* and 4*s.* 7*d.* per stone for first and second quality. A few came from Birkenhead, including some ranch-fed, which sold at a slightly lower figure.

Chilled Beef.—Argentine chilled hindquarters sold at fair prices, participating in the general fall of the third week. The best quality ranged from 3*s.* up to 3*s.* 6*d.* during the month, the average being 3*s.* 3*d.* per 8 lb. Second quality averaged 2*s.* 11*d.*, and forequarters 2*s.* 3*d.* to 2*s.* 5*d.*

Frozen Beef.—Trade in this article was very quiet, and on some days very little changed hands. The average price of the best New Zealand hindquarters was 2*s.* 9*d.* per stone. Fores fetched as much as those of chilled, and realised 2*s.* 3*d.* to 2*s.* 5*d.* per stone.

Carcass Mutton—Fresh Killed.—Scotch mutton was again in limited supply, and prices were steady at 5*s.* 8*d.* and 5*s.* 4*d.* per 8 lb. for the first three weeks, after which a rather sudden rise took place, and 6*s.* and 5*s.* 8*d.* were realised for first and second quality. Averages were: Scotch, 5*s.* 8*d.* and 5*s.* 4*d.*; English, 5*s.* 1*d.* and 4*s.* 10*d.*; and Dutch, 5*s.* and 4*s.* 9*d.* per stone.

British Lamb.—English lamb was very cheap, and at the beginning of the month was only fetching 8*d.* per lb. Scotch then began to arrive in larger quantity, selling at 5*s.* 4*d.* to 5*s.* 8*d.* per stone. In the fourth week prices went up with a bound, and some fine Scotch was sold at 7*s.* The average for the month was 5*s.* 9*d.* and 5*s.* 4*d.* for first and second quality.

Frozen Mutton and Lamb.—The best New Zealand mutton was steady at 3*s.* per 8 lb., and Argentine at 2*s.* 7*d.* New Zealand lamb declined from 4*s.* 6*d.* to 4*s.* 2*d.* towards the end of the month. The Argentine and Australian lamb on offer would be better described as small mutton.

Veal.—The trade for veal was very slack, and the price for the best carcasses seldom exceeded 7½*d.* per lb.

Pork.—Trade was naturally of a limited character, but the small supplies coming forward sold readily enough at 4*s.* to 4*s.* 6*d.* per 8 lb.

THE PROVISION TRADE IN JULY.

HEDLEY STEVENS.

Bacon.—At a time when the consumptive demand should be good, especially for hams, a quiet trade in bacon must be reported. As usual at the time of year under review, side meats have become dearer, and although the prices for other cuts have advanced, the grocer has not been stimulated thereby to buy for his August trade. The labour difficulties which have prevailed at the London docks have also had a depressing effect on the market all round. Some merchants are now having to face very serious losses in consequence of the delays in getting delivery of their perishable goods.

The arrivals of American bacon and hams have been only moderate during the month, but more than sufficient for the demand, and the stocks in cold store have not been reduced. The American packers' offers of their product for July, August, and September shipments are many shillings above spot values, and as a result there has been very little forward purchasing on English account. Advices from America report an unsatisfactory demand for hams in that country.

The receipts of hogs in America show a slight falling off, and prices have fluctuated during the month at Chicago from $6.95 to $8.30, against $6.10 to $7.65 during the same period of last year, and $7.90 to $9.40 two years ago. In Canada they are in little better supply, but prices continue high.

At most points English pigs are dearer, principally on account of the restrictions imposed as a result of the recent outbreaks of foot-and-mouth disease. It is anticipated that still higher figures will rule in the near future.

Butter.—The principal feature of the butter trade during July has been the enormous arrivals from Siberia. This has been to some extent the result of the shippers' action in delaying their goods at the seaboard in that country while the London dock strike was at its worst. Knowing what difficulty their agents would have in getting delivery, they preferred to let the consignments accumulate until the labour conditions were less acute. A good quantity of this butter has now gone into cold store. The weather conditions in Siberia are very favourable, and a large quantity of butter is being made; in fact, it is reported that the June, July, and August make will be 30 per cent. more than last year.

Australian has met with a poor demand, although on the month prices are a little firmer. Buyers have been able to fill in very largely with the home make, which is still very plentiful. The latest cable advices point to a larger make in Australia during the coming season, but a smaller one in New Zealand, as many factories in the latter colony have this year erected more cheese-making plant, in order to increase their output, which has been more profitable than butter for the past three years. The average spot price for Australian butter for the year ending June 30th, 1912, was 121*s.* 9*d.* per cwt., and that of New Zealand 125*s.* 9*d.* per cwt., or about 10*s.* per cwt. above any year's average for the past five years.

Irish creameries have been in good demand, but there has been an exceptionally small sale for all cheap grades, customers apparently preferring to buy fresh-made margarine.

Cheese.—Prices have remained abnormally high, and as a result buyers act very cautiously, both on spot and for shipment. The July make of Canadians was held at the end of the month for 61*s.* to 64*s.* c.i.f., prices which are many shillings per cwt. above those current at the same time last year, when we were suffering from serious curtailment in the make as a result of the hot weather in this country and Canada.

Early in July most of the cheese-making districts in Canada experienced a few days of extreme heat, but later cable advices report much cooler weather with rain, and although the flush of the make is now past, it should prove a good one. The estimated stocks of Canadian cheese at the end of the month were 226,000 boxes, against 214,000 at the same time last year, and 274,000 two years ago.

New Zealand cheese has been in good demand, but at lower prices, although prices are still 5*s.* to 7*s.* per cwt. above those current in July last year. A good many of the recent arrivals in London have been badly damaged by heat caused by the delays in obtaining the goods from the docks. The average spot price of New Zealand cheese for the year ending June 30th, 1912, works out at just under 70*s.* per cwt., which is 7*s.* per cwt. above the average for the last five years. In 1909–1910 the average price was 58*s.* 9*d.* per cwt. Last season's imports from that country create a record, being 24,993 tons, or nearly 4,800 tons in excess of last year. For the year ending June 30th, 1903, the total imports were only 2,617 tons. The latest cable advices report that an even larger quantity of cheese will be manufactured this season, possibly an increase of 8,000 tons.

The home make continues good, but there does not appear to be any accumulation of stocks, the earlier-made goods having gone into consumption quicker than usual.

Eggs.—The arrivals, on the whole, have been large, and a fair trade has passed in best descriptions; all undergrades have been very difficult to sell.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of July, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	ENGLAND.		SCOTLAND.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Polled Scots	9 8	9 5	47 4	43 1
Herefords	9 8	8 10	—	—
Shorthorns	9 5	8 6	46 3	42 3
Devons	9 6	8 6	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	8¼	7¼	8¾	7
Sheep:—				
Downs	8¾	7¾	—	—
Longwools	8½	7¾	—	—
Cheviots	9¼	8¼	9¼	8
Blackfaced	9	8	8½	7½
Cross-breds	8¾	8	9½	8½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Bacon Pigs	7 5	6 10	6 7	5 9
Porkers	7 6	7 0	7 0	6 3
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ *s.*	£ *s.*	£ *s.*	£ *s.*
Shorthorns—In Milk ...	21 10	17 18	22 12	18 11
,, —Calvers... ...	21 5	17 14	20 18	17 9
Other Breeds—In Milk ...	19 3	16 0	20 8	16 15
,, —Calvers ...	14 15	12 15	21 2	16 19
Calves for Rearing	2 5	1 15	2 17	2 2
Store Cattle:—				
Shorthorns—Yearlings ...	9 17	8 8	10 14	8 19
,, —Two-year-olds...	14 17	12 14	17 1	14 6
,, —Three-year-olds	18 6	16 4	—	15 15
Polled Scots—Two-year-olds	—	—	16 5	14 5
Herefords— ,,	15 15	14 3	—	—
Devons— ,,	14 0	12 0	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Downs or Longwools ...	31 5	26 2	—	—
Scotch Cross-breds ...	—	—	—	31 3
Store Pigs:—				
8 to 10 weeks old	17 0	13 5	19 4	16 3
12 to 16 weeks old	26 9	20 10	26 0	—

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of July, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.		Liverpool.		London.		Manchester.		Edinburgh.		Glasgow.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
BEEF :—		*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
English	1st	63	6	66	6	66	0	66	6	72	6*	71	0*
	2nd	57	0	63	6	63	6	63	0	64	6*	64	6*
Cow and Bull ...	1st	53	6	57	6	50	0	56	0	62	0	59	6
	2nd	46	6	51	6	45	6	51	0	53	6	49	6
U.S.A. and Canadian :—													
Port Killed ...	1st	—		67	6	66	0	—		—		—	
	2nd	—		63	6	64	0	—		—		—	
Argentine Frozen—													
Hind Quarters...	1st	40	0	41	6	38	6	41	6	41	6	40	0
Fore ,, ...	1st	33	6	33	6	33	6	33	6	35	0	34	0
Argentine Chilled—													
Hind Quarters...	1st	43	6	47	0	45	6	48	0	45	6	46	6
Fore ,, ...	1st	34	6	35	6	33	6	35	6	36	0	36	6
Australian Frozen—													
Hind Quarters...	1st	39	6	38	6	38	6	38	6	—		38	6
Fore ,, ...	1st	34	0	33	0	33	6	33	0	—		33	6
VEAL :—													
British	1st	—		75	0	71	6	72	0	—		70	0
	2nd	61	0	68	6	62	6	65	6	—		65	6
Foreign	1st	—		—		71	6	—		71	0	70	0
MUTTON :—													
Scotch	1st	—		88	6	79	6	82	0	77	0	84	6
	2nd	—		79	6	74	6	77	6	65	0	66	6
English	1st	69	6	75	0	71	6	80	6	—		—	
	2nd	59	0	67	6	67	0	75	6	—		—	
Argentine Frozen ...	1st	38	6	38	6	36	6	39	6	36	6	37	6
Australian ,, ...	1st	38	6	36	6	37	6	37	6	—		35	0
New Zealand ,, ...	1st	37	0	—		42	0	—		—		38	0
LAMB :—													
British	1st	73	0	84	0	80	6	87	6	80	6	90	6
	2nd	68	6	73	6	74	6	80	0	—		77	6
New Zealand ...	1st	61	6	61	6	60	0	62	6	64	6	60	6
Australian	1st	57	0	56	0	58	6	56	6	—		54	6
Argentine	1st	57	0	54	0	49	0	56	6	55	0	54	6
PORK :—													
British	1st	61	0	59	6	63	0	61	0	55	0	58	0
	2nd	57	6	54	6	58	6	56	0	49	0	56	0
Foreign	1st	—		—		61	6	—		—		—	

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6 ...	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
,, 13 ...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
,, 20 ...	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
,, 27 ...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3 ...	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
,, 10 ..	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
,, 17 ...	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
,, 24 ...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2 ...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
,, 9 ...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
,, 16 ...	32	6	30	1	34	0	23	6	24	11	31	2	18	0	17	6	21	8
,, 23 ...	32	9	30	2	34	1	23	7	25	0	31	10	17	11	17	5	21	9
,, 30 ...	33	0	30	3	34	4	23	8	24	11	30	3	18	0	17	5	21	8
Apl. 6 ...	33	6	30	4	34	10	23	1	24	7	30	9	17	11	17	7	21	11
,, 13 ...	33	7	30	3	35	4	23	5	25	2	30	2	18	3	18	3	22	1
,, 20 ...	33	7	30	4	36	7	23	0	25	5	29	11	18	3	17	10	22	4
,, 27 ...	33	0	30	11	37	10	22	10	25	5	30	4	18	3	18	3	22	9
May 4 ...	32	6	31	4	38	1	22	7	25	7	30	2	18	2	18	6	23	1
,, 11 ...	32	1	31	8	37	11	22	0	25	1	31	1	18	1	19	0	23	7
,, 18 ...	31	10	32	6	37	8	21	8	25	4	31	2	17	8	19	2	23	7
,, 25 ...	31	3	32	8	37	2	21	4	25	0	31	1	17	10	19	5	23	7
June 1 ...	30	2	32	5	36	10	21	8	24	10	30	0	17	10	19	5	23	9
,, 8 ...	29	1	32	4	36	11	20	9	25	7	29	11	17	10	19	7	24	0
,, 15 ...	29	0	32	3	37	0	18	11	23	11	30	8	18	0	19	8	23	10
,, 22 ...	29	4	31	11	37	5	20	1	23	9	30	8	17	9	19	10	24	0
,, 29 ...	29	9	31	10	37	10	19	11	24	5	30	2	17	7	19	9	23	11
July 6 ...	30	4	32	1	38	2	19	5	25	10	31	7	17	4	19	9	23	11
,, 13 ...	31	1	32	3	38	3	21	3	25	10	30	2	17	7	19	11	24	1
,, 20 ...	31	11	32	5	38	10	19	9	24	3	30	9	17	5	19	5	24	8
,, 27 . .	33	5	32	5	38	9	20	10	23	8	30	9	18	1	19	7	23	4
Aug. 3 .	33	9	32	0	38	4	20	5	24	4	28	6	18	3	18	2	22	2
,, 10 ...	33	5	31	6	39	2	20	4	26	9	30	7	18	0	18	0	22	4
,, 17 ...	32	11	31	6			20	11	27	8			17	11	17	10		
,, 24 ...	32	7	31	8			20	10	28	10			17	2	18	0		
,, 31 ...	32	2	31	7			22	10	28	4			17	2	18	3		
Sept. 7 ...	31	11	31	10			23	3	28	4			17	2	18	1		
,, 14 ...	30	11	32	0			24	3	29	0			16	6	18	5		
,, 21 ...	30	2	32	4			24	2	29	11			16	3	18	9		
,, 28 ...	30	1	32	6			24	4	30	5			16	4	19	1		
Oct. 5 ...	30	1	32	7			24	7	30	9			16	3	19	5		
,, 12 ...	30	2	32	9			25	1	31	0			16	2	19	10		
,, 19 ...	30	4	32	9			25	3	31	5			16	1	19	11		
,, 26 ...	30	4	33	1			25	4	31	7			16	2	20	6		
Nov. 2 ...	30	4	33	4			25	6	31	10			16	2	20	8		
,, 9 ...	29	11	33	4			25	4	32	7			15	11	20	11		
,, 16 ...	29	8	33	1			25	1	32	10			16	1	21	0		
,, 23 ...	29	11	33	0			24	10	33	5			16	4	20	10		
,, 30 ...	30	6	32	10			24	7	33	10			16	7	20	11		
Dec. 7 ...	30	9	32	9			24	3	34	0			16	9	20	9		
,, 14 ...	30	7	32	11			23	9	33	5			16	10	20	9		
,, 21 ...	30	7	32	9			23	10	33	5			16	9	20	8		
,, 28 ...	30	5	33	0			23	9	33	4			16	9	20	7		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb : Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1911.	1912.	1911.	1912.	1911.	1912.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d*
France:	June	46 8	54 5	27 4	31 2	22 9	24 11
	July	43 8	54 4	26 8	31 3	22 4	24 11
Paris:	June	47 2	56 1	27 0	29 11	23 11	25 5
	July	43 8	56 9	26 6	30 6	23 4	25 0
Belgium:	May	34 11	39 4	24 11	31 9	21 10	27 0
	June	34 10	39 4	27 4	31 0	21 10	26 9
Germany:	May	42 5	48 7	29 2	34 5	24 2	28 10
	June	42 7	47 11	28 8	34 0	25 0	28 3
Berlin:	May	44 4	49 6	—	—	23 2	28 0
	June	44 4	45 9	—	—	23 3	26 9
Breslau:	May	39 7	44 10	—* 24 9†	—* 31 11†	22 7	26 4
	June	40 5	45 5	—* 24 9†	—* 31 10†	22 10	25 4

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of July, 1911 and 1912.

—	WHEAT.		BARLEY.		OATS.	
	1911.	1912.	1911.	1912.	1911.	1912.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London...	32 11	39 11	25 3	—	20 7	24 5
Norwich	32 1	38 3	—	28 7	19 6	24 2
Peterborough	31 6	38 6	—	—	18 5	23 9
Lincoln...	32 4	38 1	—	29 11	18 6	—
Doncaster	31 8	37 8	—	—	19 4	23 10
Salisbury	31 9	38 5	22 9	—	20 1	24 7

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of July, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality	First Quality.	Second Quality.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb	per 12 lb.
British ...	13 9	12 0	—	—	13 6	12 6	14 3	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	113 0	110 0	113 6	110 0	114 0	111 0	110 0	—
,, Factory ...	106 0	102 0	105 0	99 0	106 0	101 0	—	—
Danish ...	—	—	124 6	121 0	122 6	120 6	120 0	—
French ...	—	—	—	—	122 0	118 0	—	—
Russian ..	109 0	105 0	108 0	105 0	105 6	103 0	106 0	—
Australian ...	112 0	108 0	—	—	110 6	107 6	—	—
New Zealand	116 0	114 0	—	—	115 6	113 6	—	—
Argentine ..	—	—	—	—	—	—	—	—
CHEESE:—								
British—								
Cheddar ...	75 0	68 6	73 6	69 6	73 6	70 0	68 6	66 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	65 0	60 0	74 6	70 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt		
Canadian ...	65 0	63 6	64 6	62 0	66 0	65 0	67 0	—
BACON:—								
Irish	75 0	70 6	75 0	70 6	77 0	73 0	75 0	—
Canadian ...	68 0	65 6	66 6	63 6	69 0	66 0	68 0	66 0
HAMS:—								
Cumberland ...	—	—	—	—	101 6	96 0	—	—
Irish	—	—	—	—	105 0	98 6	105 0	103 0
American (long cut)	64 0	61 0	63 6	60 0	74 0	69 0	63 0	—
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120
British ...	10 5	9 7	—	—	11 3	10 2	11 3	—
Irish	9 4	8 11	9 0	8 1	9 11	8 11	9 0	8 3
Danish ..	—	—	9 2	8 10	10 1	8 9	10 2	9 7
POTATOES:—	per ton.	per ton.	per ton.	per ton	per ton	per ton.	per ton.	per ton.
Duke of York	113 6	91 6	95 0	86 6	108 6	98 6	—	—
Other First Earlies	126 6	101 6	98 6	85 0	105 0	96 6	78 6	70 0
British Queen	91 6	80 0	105 0	96 6	85 0	73 6	—	—
HAY:—								
Clover ...	120 0	—	118 6	98 6	118 0	93 6	100 0	95 0
Meadow ...	105 0	—	—	—	111 0	88 0	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	JULY		SEVEN MONTHS ENDED JULY	
	1912	1911.	1912	1911.
Anthrax:—				
Outbreaks	32	39	529	515
Animals attacked .	45	48	601	642
Foot-and-Mouth Disease:—				
Outbreaks	51	6	55	7
Animals attacked .	246	402	284	420
Glanders (including Farcy):—				
Outbreaks .	20	10	108	114
Animals attacked .	27	18	215	291
Parasitic Mange:—				
Outbreaks	133	–	2,233	
Animals attacked	253	—	4,939	—
Sheep-Scab:—				
Outbreaks	3	1	165	304
Swine-Fever:—				
Outbreaks	230	236	2,027	1,568
Swine Slaughtered as diseased or exposed to infection	3,150	3,258	25,991	18,235

IRELAND

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	JULY		SEVEN MONTHS ENDED JULY.	
	1912.	1911.	1912	1911
Anthrax:—				
Outbreaks ...	–	1	2	6
Animals attacked		1	2	7
Foot-and-Mouth Disease:—				
Outbreaks . .	1	—	1	—
Animals attacked .. .	198	—	198	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	3
Parasitic Mange:—				
Outbreaks	2	—	47	44
Sheep-Scab:—				
Outbreaks	5	3	263	245
Swine-Fever:—				
Outbreaks	20	14	157	77
Swine Slaughtered as diseased or exposed to infection ...	106	408	1,381	1,382

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

Über den Einfluss von kohlensaurem Kalk auf die Wirkung von verschiedenen Phosphaten, *D. Prianischnikow.* (Landw. Vers. Stat., LXXV. Band, Heft V. u. VI., 1911.) [63.15; 63.1672.]

The Manufacture of Nitrates from the Atmosphere, *E. K. Scott.* (Jour. Roy. Soc. Arts, May 17 and June 14, 1912.) [63.1621; 63.1671.]

The Phosphate Industry in Algeria. (Jour. Roy. Soc. Arts, June 7, 1912.) [63.1672.]

Studies in the Inheritance of Disease Resistance, II., *R. H. Biffen.* [575.4.] Studies in Protein Hydrolysis, *F. W. Foreman.* [543.] (Jour. Agr. Sci., June, 1912.)

Bakteriologisch-chemische Untersuchungen über den Stalldünger, speziell über den Einfluss verschiedener Konservierungsmittel auf die Bakterienflora und die Gärungsvorgänge, *W. Scheffler* und *O. Lemmermann.* (Landw. Jahrb., Band XLII., Heft 3.) [63.163.]

Field Crops—

Uber den Futterwert des frischen Grases und des daraus gewonnenen Trockenfutters, *A. Morgen, C. Beger,* und *F. Westhausser.* (Landw. Vers. Stat., LXXV. Band, Heft V. u. VI., 1911.) [63.33; 612.394.]

On the Causes of the high nutritive Value and Fertility of the fatting Pastures of Romney Marsh and other Marshes in the S.E. of England, *A. D. Hall* and *E. J. Russell.* [63.33(*a*).] Distribution of the Nitrogen of Wheat between the Flour, Bran, and Shorts, *J. E. Greaves* and *R. Stewart.* [63.311.] (Jour. Agr. Sci., June, 1912.)

Plant Diseases—

Biochemische Untersuchungen über die Blattrollkrankheit der Kartoffel. III.:—Chemische Beschaffenheit kranker und gesunder Pflanzenteile, *G. Doby.* (Ztschr. Pflanzenkrank., XXII. Band, Heft 4, 1912.) [63.24–33.]

Live Stock—

Uber den Wert einiger Futtermittel tierischen Ursprunges für den Pflanzenfresser, *F. Honcamp, B. Gschwendner,* und *D. Engberding* (Landw. Vers. Stat., LXXV. Band, Heft III. u. IV., 1911.) [612.394; 63.604.]

Dairying and Food, General—

The Action of Rennet on Milk, *M. Nierenstein* and *Jessie Stubbs.* (Jour. Agr. Sci., June, 1912.) [63.73.]

Veterinary Science—

On Ovariotomy in Sows, with observations on the Mammary Glands and the internal Genital Organs, *K. J. J. Mackenzie* and *F. H. A. Marshall.* (Jour. Agr. Sci., June, 1912.) [612; 619.4.]

Birds, Poultry, and Bees—

An Investigation concerning the Food of certain Birds, *J. Hammond.* (Jour. Agr. Sci., June, 1912.) [59.162.]

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Royal International Horticultural Exhibition, 1912.—Report of the Science and Education Committee on Horticultural Education. (71 pp.) London, 1912. [37:635.]

Augé-Laribé, M.—L'Evolution de la France Agricole. (304 pp.) Paris: Librairie Armand Colin, 1912. 3.50 fr. [63(44).]

Van den Heede, A.—L'Art de Semer. (182 pp.) Paris: Librairie et Imprimerie Horticoles, 1902. 2.50 fr. [63.195.]

De Noter, R.—L'Hybridation des Plantes. (179 pp.) Paris: Librairie des Sciences Agricoles, n.d. 2.50 fr. [63.5(02); 63.1952.]

De Beauchamp, P.—Instructions for Collecting and Fixing Rotifers in Bulk (reprinted from the Proc. of the U.S. National Museum, Vol. 42). (5 pp.) Washington, 1912. [579; 59.2.]

Wiltshire County Council.—Results of the Field Manurial Demonstrations, 1910–11. (75 pp.) [63.16.]

Cornell Agricultural Experiment Station.—Bull. 297:—Studies of Variation in Plants. (593–677 pp.) 1911. [575.1.] Bull. 302:—Notes from the Agricultural Survey in Tompkins County. (767–772 pp.) 1911. [338.1; 63(73).] Bull. 312:—Germination of Seed as affected by Sulfuric Acid Treatment. (293–336 pp.) [63.1951.] Ithaca, New York, 1912.

Illinois Agricultural Experiment Station.—Circ. 155:—Plant Food in relation to Soil Fertility. (10 pp.) Urbana, Illinois, 1912. [63.161.]

*Departmental Committee on the Science Museum and the Geological Museum.**—Report. (Part II.) [Cd. 6221.] (11 pp.+2 plans.) London: Wyman & Sons, 1912. 6½*d.* [55; 579.]

Wisconsin Agricultural Experiment Station.—Research Bull. 22:—Metabolic Water: Its Production and Rôle in Vital Phenomena. (87–181 pp.) Madison, Wisconsin, 1912. [58.11.]

New Jersey Agricultural Experiment Stations.—Bull. 227:—Tests of Commercial Cultures for Soil Inoculation. (23 pp.) New Brunswick, N.J., 1910. [576.83.]

Georgia Agricultural Experiment Station.—Bull. 95:—The Influence of Stall Manure upon the Bacterial Flora of the Soil. (36 pp.) Experiment, Georgia, 1911. [63.163; 63.115.]

Field Crops—

New Zealand, Dept. of Agriculture, Commerce, and Tourists.—Bull. No. 4 (New Series):—Stack Ensilage. (2 pp.) Wellington, 1910. [63.198.]

Arizona Agricultural Experiment Station.—Bull. 67:—Native Cacti as Emergency Forage Plants; Nutritive Value of Cholla Fruit. (457–519 pp. +viii. plates). Tucson, Arizona, 1911. [63.33(*d*).]

South Dakota Agricultural Experiment Station.—Bull. 128:—Progress in Wheat Investigations. (121–144 pp.) [63.311.] Bull. 129:—Growing Pedigree Sugar Beet in South Dakota in 1910. (145–160 pp.) [63.3432.] Brookings, South Dakota, 1911.

Cornell Agricultural Experiment Station.—Bull. 310:—Soy Beans as a Supplementary Silage Crop. (257–276 pp.) Ithaca, New York, 1912. [63.604(*a*); 63.33(*d*).]

Horticulture—

New Zealand, Department of Agriculture, Commerce, and Tourists.—Bull. 11 (New Series):—The Grape-Vine and the Pruning and Management of Vines in a mixed Orchard or Garden. (11 pp.) 1911. [63.46.] Bull. 14 (New Series):—The Orchard and Fruit Garden. (20 pp.) 1912. [63.42.] Bull. 15 (New Series):—Apple-Packing. (12 pp.) 1912. [63.41(*a*); 63.41–198.] Wellington.

New South Wales, Department of Agriculture.—Farmers' Bull. 52:—Fruit-drying. (22 pp.) Sydney, 1911. [664.85.]

De Noter, R.—Monographe Horticole des Plantes Bulbeuses, Tuberculeuses, etc. (385 pp.) Paris: Librairie des Sciences Agricoles, 3.50 fr. [63.52.]

*Vilmorin-Andrieux et Cie.**—Les Fleurs de Pleine Terre. (1375 pp.) Paris: Vilmorin-Andrieux et Cie., 1909. 18 fr. [63.52.]

Arizona Agricultural Experiment Station.—Bull. 66:—Chemistry and

Ripening of the Date; Ripening Dates by Incubation. (398–456 pp.) Tucson, Arizona, 1911. [63.41(*e*).]

California Agricultural Experiment Station.—Bull. 227:—Grape Vinegar. (341–366 pp.) Sacramento, 1912. [663.]

Cornell Agricultural Experiment Station.—Bull. 306:—Classification of the Peony (fourth report). (55–159 pp.) [63.52.] Bull. 307:—An Apple Orchard Survey of Ontario County. (160–216 pp.) [338.1; 63.41(73).] Ithaca, New York, 1911.

Oregon Agricultural Experiment Station.—Bull. 110:—Preliminary Frost Fighting Studies in the Rogue River Valley. (62 pp.) Corvallis, Oregon, 1911. [63.21.]

Georgia Agricultural Experiment Station.—Bull. 96:—Tomatoes: (i.) Varieties, Culture and Canning; (ii.) Blossom-end Rot. (37–92 pp.) Experiment, Georgia, 1911. [63.24–51; 63.513; 664.84.]

New Jersey Agricultural Experiment Stations.—Bull. 228:—Structure of Tomato Skins. (20 pp. + viii. plates.) 1910. [63.513.] Bull. 238:—The F_1 Heredity of Size, Shape, and Number in Tomato Leaves.—Part I. Seedlings. (38 pp. + ix. plates.) 1911. [575.4; 63.513.] Bull. 239:—The F_1 Heredity of Size, Shape, and Number in Tomato Leaves.—Part II. Mature Plants. (12 pp. + ix. plates.) 1911. [575.4; 63.513.] Bull. 242:—The F_1 Heredity of Size, Shape, and Number in Tomato Fruits. (39 pp. + iii. plates.) 1912. [575.4; 63.513.] New Brunswick, N.J.

Plant Diseases—

New South Wales, Department of Agriculture.—Farmers' Bull. 50:—Black Oats. (13 pp.) Sydney, 1911. [63.259.]

Fuchs, Dr. G.—Morphologische Studien über Borkenkäfer. II., Die europäischen Hylesinen. (53 pp. + iii. plates.) München: E. Reinhardt, 1912. [63.27–49.]

Missouri Agricultural Experiment Station.—Bull. 102:—Combating Orchard and Garden Enemies. (237–290 pp.) Columbia, Missouri, 1912. [63.29.]

U.S. Dept. of Agriculture, Bureau of Entomology.—Bull. 95, Part V.:—The False Wireworms (*Eleodes*) of the Pacific North-west. (73–87 pp.) Washington, 1912. [63.27–31; 63.27–33.]

California Agricultural Experiment Station.—Bull. 228:—New Control Methods for the Pear Thrips (*Euthrips pyri*) and the Peach Tree Borer (*Sanninoidea pacifica*). (367–374 pp.) Sacramento, 1912. [63.27.]

Cornell Agricultural Experiment Station.—Bull. 308:—The Plum Leaf-Miner (*Nepticula Slingerlandella,* Kearfott). (217–228 pp.) 1911. [63.27.] Bull. 311:—The Fruit-Tree Leaf-Roller (*Archips Argyrospila*). (277–292 pp.) 1912. [63.27.] Ithaca, New York.

Ewart, A. J.—On Bitter Pit and the Sensitivity of Apples to Poisons [reprinted from Proc. Roy. Soc. Victoria, Vol. XXIV. (New Series, Pt. II.)]. (367–419 pp.) Melbourne, 1912. [63.21.]

New Jersey Agricultural Experiment Stations.—Bull. 226:—Peach Yellows and Little Peach. (26 pp.) New Brunswick, N.J., 1910. [63.24.]

Live Stock—

New South Wales, Department of Agriculture.—Pigs and their Management, with Chapters on Construction of Sties and Diseases of the Pig. (182 pp.) Sydney: W. A. Gullick, 1910. 3*s.* 6*d.* (cloth). [63.64; 63.6:69; 619.4.]

South Dakota Agricultural Experiment Station.—Bull. 125:—Fattening Steers of different Ages. (59–72 pp.) [63.62.] Bull. 127:—Breeding and Feeding Sheep. (97–120 pp.) [63.63.] Brookings, South Dakota, 1911.

Cornell Agricultural Experiment Station.—Bull. 309:—The Production of "Hothouse" Lambs. (229–256 pp.) Ithaca, New York, 1912. [63.63; 63.751.]

Critchell, J. T., and *Raymond, J.*—A History of the Frozen Meat Trade. An Account of the Development and Present-Day Methods of Preparation, Transport, and Marketing of Frozen and Chilled Meats. (442 pp.) London: Constable & Co., Ltd., 1912. 10*s.* 6*d.* net. [63.75; 664.91.]

Harper, M. W.—The Training and Breaking of Horses. [Rural Science Series.] (387 pp.) New York: The Macmillan Co., 1912. 7*s.* 6*d.* net. [63.61.]

Dairying and Food, General—

Cooper, W. F.—Churnability of Cream. (10 pp.) [Reprinted from the Journal of the Roy. Agr. Soc., Vol. 71, 1910.] [63.712.]

Pennsylvania Agricultural Experiment Station.—Bull. 114:—Computation of Dairy Rations. (20 pp.) Centre County, Pennsylvania, 1912. [612.394; 63.711(*a*).]

Illinois Agricultural Experiment Station.—Bull. 153:—Comparison of Methods of Sampling Cream for Testing. (563–574 pp.) Urbana, Illinois, 1912. [543.2.]

Veterinary Science—

U.S. Department of Agriculture, Bureau of Animal Industry.—Circ. 194:—The Protozoan Parasites of Domesticated Animals. (463–498 pp. + vii. plates.) [59.169.] Washington, 1912. Circ. 196:—Some Results of Cattle-Tick Eradication. (4 pp.) [59.169(*b*).]

New Zealand, Department of Agriculture, Commerce, and Tourists.—Bull. 3 (New Series):—Parasitic Gastritis of Sheep (principally Lambs and Hoggets). (8 pp.) 1910. [619.3.] Bull. 8 (New Series):—A Lecture about Brood Mares. (8 pp.) 1911. [619.1.] Bull. 9 (New Series):—Some of the Common Ailments in Foals. (8 pp.) 1911. [619.1.] Wellington.

South Dakota Agricultural Experiment Station.—Bull. 131:—Scabies (Mange) in Cattle. (201–216 pp.) Brookings, South Dakota, 1911. [619.2.]

Cornell Agricultural Experiment Station.—Bull. 299:—The Elimination of Tubercle Bacilli from Infected Cattle, and the Control of Bovine Tuberculosis and Infected Milk. (697–714 pp.) Ithaca, New York, 1911. [614.5.]

*Departmental Committee on Foot and Mouth Disease.**—Report. [Cd. 6222.] (12 pp.) London: Wyman & Sons, 1912. 1½*d.* [619.2(*d*).]

S.E. Agricultural College, Wye.—Johne's Disease of Cattle and Sheep. (3 pp.) [619.2.]

Birds, Poultry and Bees—

Royal Society for the Protection of Birds.—Farm, Garden, and Birds: How to protect Grain, Fruit, and other crops without Destruction of Bird-Life. (67 pp.) London: Witherby & Co., 1912. 1*s.* [59.162.]

New Zealand, Department of Agriculture, Commerce, and Tourists.—Bull. 1 (New Series):—Foul-Brood in Bees and its Treatment. (7 pp.) 1910. [63.81.09.] Bull. 13 (New Series):—Poultry and Eggs for Market and Export. [Sixth edition.] (70 pp.) 1911. [63.65(04).] Wellington.

New South Wales, Department of Agriculture.—Farmers' Bull. 51:—Poultry-farming. (29 pp.) Sydney, 1911. [63.651.]

Forestry—

New Zealand, Department of Agriculture, Commerce, and Tourists.—Bull. 12 (New Series):—Waipoua Kauri Forest, one of the last Homes of New Zealand's Greatest Timber Tree. (11 pp.) Wellington, 1911. [63.49(931).]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P. 1c–9. 6,000. 8/12. R. C. & S., Ltd.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE

Vol. XIX. No. 6.

SEPTEMBER, 1912.

MINIMISING THE LOSS CAUSED BY POTATO DISEASE.

IN view of the prevalence of potato disease this year, a few suggestions may be made with regard to keeping the loss as low as possible. The disease, due to the fungus, *Phytophthora infestans*, is first noticed, as a rule, on the leaves and haulms in the form of dark spots or patches (surrounded very often by a little ring of white powder), which spread rapidly in a wet or moist season and soon destroy the whole of the plant above ground. The life-history of the disease has not been fully worked out, but it is almost certain that tubers are infected by the fungus mycelium making its way down the tissues of the haulm.

The longer the tubers remain in the ground the greater is the danger of their becoming diseased, and, as no growth of tubers can take place after the haulm has died, the crop should be lifted as soon as the skin will resist rubbing. The first effect of disease on the tubers is to cause the characteristic dark brown discoloration of the flesh; after the cells have been killed by the fungus, bacteria secure a hold and bring about the putrefaction and softening of the tissues commonly referred to as "wet rot." It is possible, too, that the fungus (*Nectria solani*, Pers.) causing Winter Rot more easily attacks tubers affected by *Phytophthora* than it does healthy ones.

When the crop is lifted it would be highly desirable, if it were possible, to have all diseased tubers—even if only "just touched"—separated from healthy ones, but in most cases this is out of the question. Apart from the pressure of work during the potato harvest, the tubers in a bad season such as the present are too wet and dirty to make it possible to distinguish between the sound and the slightly affected. The difficulty can be got over to a great extent, however, by the plan adopted in some districts of placing the potatoes, as they are raised, in small temporary "pits" or "clamps," covered simply with straw, and leaving them in these until the pressure of work is over, by which time the tubers will have dried considerably. By sorting at this later stage before placing in the more permanent pits, there is not only less danger of sound tubers becoming infected in the pits, but a large bulk of slightly diseased potatoes will be obtained quite suitable for immediate use as food for stock, but which if left for even two or three months would become quite rotten and useless.

The construction of the pits or clamps has a good deal to do with the proper keeping of the tubers. In a wide, deep heap it is not easy for "steam" to escape, and in the present season it would be advisable to make the pits exceptionally narrow. Needless to say, the piece of ground selected as the site of the clamp should be as dry as possible; if it is not thoroughly dry and well drained, the floor of the clamp should be raised a little above the level of the surrounding ground rather than excavated even to the slight extent which is common.

The covering of the clamp is of great importance. In some parts of the country it is the custom after covering the heap of tubers with straw to earth it completely over at once. Such a plan is decidedly bad, and certainly conduces to extensive rotting in the pit. Even in a small clamp there is a certain amount of "heating," probably chiefly due to the ordinary respiration of the tubers, and "steam" or "sweat" is produced, particularly in the first few weeks. This heating can be shown by direct measurement, or it might be deduced from the fact that in ordinary circumstances potatoes dry in the pit. If the "steam" is confined by a close covering of soil, ideal conditions for the rotting of the tubers are secured. Ample facilities should, therefore, be provided for the escape of the "steam" during the first few weeks after storing; perhaps the best plan is the common one of leaving the ridge of the clamp covered only with straw. If good straw has been used, and properly laid on, no water will find its way to the potatoes, and a complete covering of soil may be given before hard frost is expected. Some potato growers, even in parts of Scotland where severe frosts are experienced, leave the ridge without soil throughout the winter, simply putting on a layer of potato tops or of strawy manure when frosts are anticipated. This is probably carrying the principle further than necessary, and a better plan is to cover the clamps completely with soil after a month or so, leaving, at intervals of a few feet, ventilating shafts in the form of drain pipes or wisps of straw.

With regard to the condition of the tubers when put into the clamps, it is generally thought that they should not be too clean, as a little soil or sand adhering to them prevents their coming into too close contact and so minimises "heating" and the spread of rot from one tuber to another. In a season like the present one there is little danger of the tubers being too clean, and in many cases they will be very wet and dirty. In such cases, and always when diseased tubers are present, some growers adopt the plan of dusting a little lime among the tubers. Experiments carried out by the University of Leeds showed that when this was done the potatoes came out of the clamps in spring "very clean and bright," and though the lime did not prevent a diseased tuber decaying, it did prevent rot spreading from a bad tuber to those in contact with it. Ground lime (*i.e.*, ground quick-lime) proved to be much better for this purpose than slaked lime. It was found that the use of the lime was attended with the disadvantage that it seemed to encourage the early sprouting of the tubers, but this may be regarded as a small matter compared with the prevention of the spread of rot through a clamp, and the sprinkling of ground lime in the clamp at the rate of about 1 cwt. to every ton of potatoes is confidently recommended.

Flowers of sulphur, sprinkled over the tubers in the clamp at the rate of 2 lb. per ton of tubers, also destroys the fungus causing Winter Rot, and holds in check certain mites, woodlice, &c., which may otherwise convey the spores from one potato to another. [See also Leaflets No. 23 (*Potato Disease*), No. 117 (*Black-Leg or Potato Stem-Rot*), No. 193 (*Winter Rot of Potatoes*), and No. 242 (*Bacteriosis of the Potato and Tomato*)].

JOHNE'S DISEASE.

JOHNE'S DISEASE may be described as a chronic bacterial enteritis caused by a specific bacillus. It was first described in cattle by Johne and Frothingham. The bacillus belongs to the group of acid-fast bacilli, that is to say, when stained with certain stains, the bacilli are not decolorised by strong solutions of acids. The bacilli are present in varying numbers under the mucous coat of the intestine. They are also often present in the mesenteric lymphatic glands.

Animals Affected.

The disease has been found in cattle, sheep, and deer in Great Britain, and on certain farms it appears to be very prevalent amongst cattle. It has a prolonged period of incubation which may extend to a year or more before definite symptoms appear. This, of course, accounts for the very insidious character of the disease. In an infected herd it does not often happen that a very large proportion of the animals show clinical symptoms at the same time. The history usually is that one or two animals develop the disease at intervals, and this may have been going on for years. The first symptom observed in cattle is, as a rule, that in spite of good feeding the affected animal loses condition, presents an unthrifty appearance, and the coat is erect. This unthriftiness may persist for several months before more typical symptoms of the disease appear. The most typical symptom is persistent diarrhœa, which may be checked, though only temporarily, by drug treatment and dry feeding stuffs. In cows the diarrhœa frequently starts shortly after calving. The affected animal may live in this condition for months, and finally die from emaciation and exhaustion, or the disease may have a fatal ending a few weeks after the diarrhœa has started. Amongst sheep the symptoms are similar to those described in cattle. In an outbreak reported to the Board, the clinical symptoms started suddenly after the sheep had been put on to roots.

Post-Mortem Appearances.

The lesions are those of chronic enteritis. In most cases in cattle the small intestine shows the more typical lesions, but even the true stomach may be attacked. The stomach and the intestine in some parts may be œdematous; in other parts the intestine may show nothing more than a mucus enteritis, in which case the surface of the mucous membrane is very pale in colour and covered with slimy mucoid material. The most marked lesions are generally found in the last portion of the small intestine, but parts of the large bowel may also be badly affected. In these situations the bowel is thickened, and its inner surface has a distinctly wrinkled appearance. In sheep the small intestine may also be thickened, and may show numerous small hæmorrhages under the mucous membrane. The thickening and wrinkling of the internal surface is not so marked as in cattle, but distinct longitudinal ridging in addition to small hæmorrhages may be found in the large intestine. The diagnosis can be easily made by an expert by examining scrapings from the affected mucous membrane. Such scrapings usually contain large numbers of the specific bacilli.

Infective Material and Method of Infection.

With the bowel in the condition described, it follows that the fæces are likely to contain the bacilli in enormous numbers, and it may be safely assumed that the evacuations from the bowel are the chief factors in the dissemination of infective material. This, of course, may occur either in the buildings or at pasture. For example, the pastures or the water supply may be soiled with infected dung, and some of the dung either in the dry or moist state may contaminate food within the buildings. So far as the latest experimental knowledge carries us, it would seem that infective material is taken in by the mouth. The amount of virulent material, however, necessary to cause infection has not been determined, but it seems certain that the greater the amount of virulent material to which animals have access, the more likely they are to become seriously affected.

Prevention.

It has already been pointed out that the disease has a very long incubative period, and an animal may be infected and infective to others for a year or more without showing the distinct clinical symptoms which would enable a positive diagnosis to be made. In these circumstances, and in the absence of a diagnostic agent of the nature of tuberculin, prevention is an exceedingly difficult matter. Clearly, however, those animals which have reached the scouring stage must be those which are evacuating the largest number of bacilli. Inasmuch as such animals have never been known to recover, and since the longer they are kept the more emaciated they become, they should immediately be isolated, and sent to the butcher. Once it becomes known that Johne's Disease exists in a herd, the owner would probably follow the cheapest and wisest course if he isolated all his animals which showed continuous unthriftiness and sent them to the butcher before the stage of diarrhœa had time to supervene. The dung from such animals should be carefully disinfected, and, if possible, pastures on which badly infected animals have run should be ploughed and cultivated.

In purchasing animals to add to a herd, the purchaser would be wise to obtain a guarantee that his purchases have not come from an infected farm; it is not sufficient to know that animals from an infected farm are absolutely healthy in appearance at the time of purchase, as they may have the seeds of the disease in their intestines.

THE FORMATION OF PRUSSIC ACID FROM LINSEED CAKE AND OTHER FEEDING STUFFS.

S. J. M. AULD, D.Sc.(Lond.), Ph.D., F.I.C.

South-Eastern Agricultural College, Wye.

A considerable amount of attention has been paid in recent years to the formation of hydrocyanic acid in plants, and since a number of these plants are used as feeding stuffs, the matter has assumed great importance with regard to the welfare of stock fed on such material.

In each case, when the ground-up plant or seed is placed in water the contained glucoside is hydrolysed, with the formation of hydrocyanic acid. The terms "cyanogenesis" and "cyanophorism" have been variously ascribed to this phenomenon by Dunstan and by Armstrong.

The question of cyanogenesis became of particular and immediate importance several years ago, owing to the importation into this country of large quantities of "Java" beans, which were used as a feeding stuff, and which caused the death of numerous animals throughout the United Kingdom. The potential prussic acid content of these beans was found to vary from 0·038 per cent. up to a maximum of 0·123 per cent., and their poisonous character was very marked.

Owing to the amount of attention drawn to the subject, the importation and use of the "Java" beans has apparently ceased, but the experience has left behind it a suspicion, which has tended to increase, of other feeding stuffs which contain cyanogenetic glucosides, and notably of linseed and linseed cake.

Although it was established as long ago as 1883 that linseed is capable of yielding appreciable quantities of hydrocyanic acid, the fact was apparently little known, or its practical importance not realised, until Henry and Auld in 1908 pointed out that linseed cake, consisting merely of crushed flax seed freed from oil, must be capable of extensive cyanogenesis. On examining a number of linseed cakes, these investigators actually found them to contain considerable quantities of the glucoside phaseolunatin, and offered as an explanation of the generally assumed non-poisonous character of linseed cake that during the process of hot expression of the oil the enzyme is completely destroyed by the high temperature, so that when the cake is eaten by stock no decomposition of the glucoside occurs in the stomach. Two samples of cake quoted yielded respectively 0·032 and 0·045 per cent. of prussic acid on distillation of their extracts with sulphuric acid, but no prussic acid was liberated when the cakes were ground and placed in water.

This inaction, however, is not the general rule, and later experience has shown that although in some cases the prussic acid is not liberated from the glucoside present in cake, the majority of linseed cakes will furnish, at any rate, a proportion of their hydrocyanic acid on soaking in water. Indeed, of the large number of oil cakes examined by the writer during the past year only a few were found to give no hydrocyanic acid on soaking with water, and allowing to stand. This may possibly be due to the increased adoption of oil-presses of the Anderson type, which press linseed in the cold state, or, at any rate, the use of a lower temperature during pressing, whereby some, at least, of the glucosidoclastic enzyme escapes destruction. It is noteworthy, however, that in no case was a diminished rate of formation of prussic acid noted in cakes of lower oil content, which might be assumed to have been pressed at a higher temperature or kept under the influence of heat for a longer period.

Quantity of Prussic Acid produced from Linseed Cake.—Besides the figures quoted above, results have been put on record by Smetham, who obtained 0·017 per cent. of prussic acid; by Dyer, who quoted one cake which gave the large quantity of 0·06 per cent. of hydrocyanic acid on distillation with acid, and about one-third of that quantity on soaking in water for thirty-six hours; and by Lander.* The last-named author found a maximum of 0·026 per cent. of free or "available" prussic acid in the cakes examined by him, but quotes a sample analysed by Voelcker which gave 0·051 per cent. of hydrocyanic acid.

In the large number of linseed and linseed-containing cakes examined during the present investigation, the content of free prussic acid was found to vary from 0·001 per cent. up to 0·052 per cent. The latter figure, the highest obtained by the writer, was obtained after six hours by soaking the cake in water at 38° C. This quantity is equivalent to 3·9 grains of prussic acid per lb.

Little evidence exists as to the lethal dose of prussic acid for animals. Lander (*loc. cit.*) found a dose of potassium cyanide equivalent to 30 grains of prussic acid necessary to cause the death of a heifer (six months), but this quantity seems rather excessive, particularly in view of the deaths which have occurred amongst full-grown cattle through eating comparatively small quantities of "Java" beans.

The minimum lethal dose for a man is usually placed at one grain, but to give a margin for individual cases may be taken as two grains for a man weighing 160 lb. If for animals the lethal dose is, weight for weight, the same as in man, this would mean a lethal dose of 1·5 grains for a sheep weighing 120 lb., and 7·5 grains for a calf weighing 600 lb., or only 0·41 lb. of the cake producing 0·052 per cent. of hydrocyanic acid cake for the sheep and 2 lb. for the calf.

---

* See *Journal*, Vol. xvii, Feb. 1911, p. 904.

It would thus seem that the (assumed) lethal doses for the various animals might be easily reached if the prussic acid is formed during mastication and digestion to the same extent to which it is formed on soaking with warm water.

Poisoning by Linseed Cake.—Poisoning by linseed cake has been known to occur in many cases, and has frequently been put on record. Linseed cake is, however, generally regarded as one of the safest and most wholesome foods the farmer can use, and cases of death, which may possibly have been due to prussic acid formation, have generally been explained away as due to the presence of castor seed cake or husk, or to some obscure disease, &c.

On the other hand, since the question of prussic acid formation has attained a more general interest, there has been rather a tendency in some quarters to attribute the death of stock receiving even a small ration of linseed cake to cyanogenesis. In some cases "scare" head-lines in local papers and an undue amount of attention to the subject have resulted, the effect being to prejudice the use of what may have been a perfectly harmless food-stuff. Until the matter has been thoroughly thrashed out, this course is to be deprecated, and until every other possible cause of death has been eliminated, poisoning by prussic acid generation should not be too seriously considered.*

Analyses of Cakes from Different Sources.—A large number of linseed and linseed-containing cakes of different origins were examined with regard to their content of cyanogenetic glucoside and of "free" hydrocyanic acid. Contrary to expectations, very few cases were found in which no free prussic acid existed, *i.e.*, in which all enzyme had been destroyed. The maximum amounts of prussic acid also were obtained from two genuine 95 per cent. English linseed cakes. Unlike the Calcutta cake examined by Voelcker (*vid. sup.*), stock showed no objection to eating these cakes, at any rate, when fed in the dry state.

---

* Since these remarks were penned two definite cases of prussic acid poisoning of calves have been traced, by Mr. W. Lincolne Sutton, F.I.C., to the linseed cake employed.

The "free" prussic acid was determined by macerating the ground cake with water for twenty-four hours at blood-heat, and the "total" prussic acid by distilling the alcoholic extract of the cake with dilute sulphuric acid.

Rate of Formation of Prussic Acid from Linseed Cakes.—The formation of prussic acid from linseed cakes varies considerably in velocity with different cakes, especially in the preliminary stages, implying the presence of different quantities of active enzyme. The most remarkable point noted was the great rapidity with which the prussic acid is formed in the early stages, particularly when kept at temperatures approximating to blood-heat. Half of the available prussic acid is frequently liberated in fifteen minutes, and the maximum is practically reached within six hours, and sometimes in considerably less time.

Effect of Temperature.—The effect of temperature on the rate of formation of prussic acid from linseed cake is most marked, and has, of course, a practical bearing with regard to the temperature at which linseed cake gruel, &c., may be made.

Thus in one hour only 28 per cent. of the cyanogenetic glucoside is decomposed at 10° C., as against 60 per cent. when the action is carried out at blood-heat.

Preparation of Linseed Cake for Stock.

As a rule, linseed cake is not fed to stock in the moist condition unless as a gruel for calves. When given in the dry state there is no danger of prussic acid being formed previous to feeding, and the conditions prevailing in the digestive tract are very diverse, and will be considered later.

Preparation of Linseed Cake Gruel.—It will be gathered from the previous statements that a gruel improperly made with cold, luke-warm, or even with hot water, and allowed to stand (and incidentally to cool) is liable to contain practically all the "available" prussic acid of the cake, unless the temperature is so high that all the enzyme is destroyed. Even a small quantity of active enzyme remaining will be capable, in time, of hydrolysing the greater part of the glucoside, and the loss on standing, by volatilisation, of prussic acid from a linseed gruel is comparatively small at low temperatures.

Two methods of preparing calf gruel with boiling water are in general use. The meal is either thoroughly mixed with boiling water and then brought to the required temperature by diluting with water or skim-milk, or else a larger quantity of boiling water is used and the mixture allowed to stand, covered over with a sack or other cloth, in a warm place for a number of hours, and then given to the calves. The latter method produces better gruels, and by maintaining a high temperature for a considerable time is more likely completely to destroy the enzyme.

In one experiment 25 grams of the powdered cake were mixed with boiling water and then diluted with cold water (about 250 c.c.) to 38° C. After standing at this temperature for fifteen minutes the amount of prussic acid generated was found to be 0·0027 per cent.

A gruel was then prepared as for practical purposes as follows: 8 oz. of linseed cake meal (0·052 per cent. free prussic acid) were thoroughly mixed by stirring with two quarts of boiling water, the containing vessel covered over, and allowed to stand in a warm place. The temperature of the mixture was noted at intervals, and after it had fallen to 55° C., at which temperature any undecomposed enzyme might be supposed to possess an appreciable activity, a series of estimations of prussic acid was made extending over seven hours. The temperature of the mixture was maintained at over 80° C. for about forty minutes. The results given below show conclusively that a gruel properly made with boiling water will not generate prussic acid even after standing indefinitely before feeding, and that the enzyme may be supposed to be completely destroyed by the action of the heat.

Prussic Acid Produced from a Linseed Gruel.

Quantities of material as mentioned above:—

Time of Standing	Temperature Degrees C	Prussic Acid formed per cent.
—	95	—
40 mins.	80	—
70 ,,	57	0·0033
2 hours	45	0.0035
3 ,,	35	0·0021
4 ,,	32	0·0020
8 ,,	15	0·0021

Within the limits of experimental error, due to difficulty of sampling, these figures may be regarded as constant, and the amount of prussic acid formed as negligible.

Effect of Other Feeding Stuffs, &c., on the Formation of Prussic Acid from Linseed Cake.

The specific enzyme of the cyanogenetic glucoside of linseed occasionally occurs in nature apart from the glucoside. It exists in ordinary brewers' yeast, since the latter material effects a resolution of phaseolunatin (the cyanogenetic glucoside of linseed) incommensurable with the small amount of emulsin present. There is, therefore, a possibility that other materials, fed in a ration with linseed cake, may contain the same enzyme, and thus, in effect, transform a safe enzyme-free cake into a prussic-acid-containing one, or by increasing the existing enzyme content of the feed, they may hasten the rate of evolution of hydrocyanic acid, and thereby increase its relative toxicity to the animal.

This may possibly be the case with substances liable to contain yeast cells, such as brewers' and distillers' residues, or mouldy and partially fermented foods, and also with the green fodders, &c., some of which are known to contain glucosidoclastic enzymes.

Brewery and Distillery Waste Products.—Brewers' grains, the waste product left from the mash, were examined for the presence of yeast. The samples examined, however, contained none, and in agreement with this no increased formation of prussic acid took place when the grains and the linseed cake were incubated together in the moist condition. Moist grains, however, readily become sour and mouldy, and in this condition might be distinctly injurious, as many of the commoner moulds are capable of effecting the hydrolysis of cyanogenetic glucosides.

Distillery waste, the residue left after alcoholic fermentation of the washed grain and removal of the alcohol, is more likely to contain yeast residues. Unfortunately, samples of the fresh material could not be obtained, and no results are therefore available.

Influence of Green Fodders on the Formation of Prussic Acid.—A large number of green fodders, likely to be fed with linseed cake, were examined in order to determine whether they were capable of producing hydrocyanic acid from it. The plants chosen—rye, lucerne, tares, kidney vetch, helianti, maize, and seeds hay—do not represent the whole range of fodders available, but were decided upon as being characteristic green-feeds, as in the case of rye and lucerne, or because they were known or asserted to contain glucosidoclastic or sucroclastic enzymes, as in the case of maize and the kidney vetch.

The results obtained with the different green fodders are of a highly interesting character. In the first place, the action of the various plant extracts, either in a positive or negative direction, is very small, and is not, apparently, definitely to be correlated with the existence in them either of active enzymes or of inhibiting substances like sugars, &c. On the other hand, where the finely ground plant is used, an invariable and considerable inhibition of the prussic acid formation takes place. This was repeatedly confirmed, both under the same and altered conditions of experiment to admit of thorough mixing by shaking, &c.

Further experiments showed the inhibiting action of the fodders to be due to their crude fibre or cellulose, and this was confirmed both with linseed cake and with isolated glucosides by using pure cellulose. The inhibition of the formation of prussic acid in this case is due to the production of an absorption or physical compound between the two colloids—enzyme and cellulose.

Effect of other Substances on the Formation of Prussic Acid from Linseed.

Although in general the neutral salts have little effect on the hydrolysis of glucosides by enzymes, *common salt*, which is likely to be fed at the same time as linseed, has a distinct inhibiting action on the liberation of prussic acid from linseed cake. The quantity of salt added was, proportionately to the weight of cake, about that likely to be given in practice.

As regards *sugars*, the inhibitory action of glucose on the hydrolysis of glucosides by enzymes has repeatedly been noticed by investigators in this field. On the other hand, the biose sugars in general have no such action. The possible activity of the sugars is of special importance in the present case, since they are very likely to be present in other foodstuffs, and in the form of molasses or molasses-feeds may possibly be given in the free condition. Experiments were therefore carried out with cane sugar, glucose, and with ordinary feeding molasses.

An extended series of experiments with *cane sugar* was carried out, but with negative results. No inhibitory action was noticed with quantities of cane sugar up to 40 per cent. by weight of the linseed cake incubated with water at 36° C.

Commercial *glucose* in the form of a 10 per cent. solution was added in increasing amounts to definite quantities of linseed cake made into a thin paste with water. The inhibiting action on the liberation of prussic acid was found to be very marked. This is in agreement with results previously obtained with isolated glucosides.

Molasses consists largely of cane sugar. There is always, however, a quantity of hexose sugar present (glucose may amount to from 20 to 30 per cent.), besides a high proportion of non-protein nitrogenous material, which averages about 10 per cent., and large amounts of inorganic salts. Added in quantities, expressed as actual sugar, up to 10 per cent. by weight of the linseed cake used, the inhibiting action was very strong; so strong, in fact, as to leave little doubt that the glucose present is not the only agent active in preventing the formation of hydrocyanic acid, and the possibility of the "amides" and the inorganic salts having an action must be considered.

The considerable inhibition of the formation of prussic acid effected by molasses may be regarded as of special importance, since it may be used either in the liquid form or as a molasses feed, in conjunction with linseed cake or other of the more markedly toxic prussic-acid-containing feeding stuffs, such as "Java" beans or sorghum. Indeed, a definite recommendation to feed glucose or molasses may be made, particularly in the latter cases.

Conditions in the Digestive Tract Relative to the Formation of Prussic Acid from Linseed.

Factors likely to influence the formation of hydrocyanic acid from feeding stuffs in the digestive organs of the animal are the acidity and alkalinity of the media and the various digestive enzymes. The action might conceivably be either positive or negative, since small quantities of acid and alkali are known to increase the activity of certain enzymes, and there is always the important possibility of the secretion in the alimentary canal of a ferment capable of effecting the hydrolysis of cyanogenetic glucosides. On the other hand, higher concentrations of acid and alkali might inactivate or destroy the specific feeding-stuff-enzyme, and the action of the commoner digestive enzymes—pepsin and trypsin—might also be expected to lie in the direction of inhibition or destruction of its activity.

Effects of Acids and Alkalis.—The influence of dilute acids and alkalis on the hydrolysis of isolated phaseolunatin and amygdalin is so considerable that a statement by Lander (*loc. cit.*) to the effect that "fermentation goes on in 1 per cent. hydrochloric acid and also in 1 per cent. sodium bicarbonate solutions, and would not therefore be inhibited by the body fluids," appeared surprising.

On repeating the experiments it was found that this is a purely empirical assertion, and though the action does continue to a certain extent, yet the inhibitory effect is very marked, and might well make all the difference between toxicity and non-toxicity.

Very similar results were obtained with sodium bicarbonate solution. More dilute solutions (0·1, 0·2 per cent., &c.), had less effect, but were still very active, and are more likely to represent the actual conditions in the digestive organs.

Effect of Digestive Juices.—Before making actual feeding experiments with animals, attention was turned to the effect of isolated pepsin and extract of the digestive stomach of a sheep on the cyanogenesis of linseed cake.

The action with pepsin-hydrochloric acid, though smaller than some of the inhibitions recorded, is distinct, and there is no doubt that the linseed enzyme is partially digested and its activity destroyed at the same time as the other proteins.

An extract of the fresh digestive stomach of a sheep was prepared by mincing the lightly washed organ and extracting with a 3 per cent. solution of glycerine containing 0·2 per cent. of hydrochloric acid. The mixture was vigorously stirred for six hours at 38° C., and filtered. Although the extract was active towards coagulated white of egg, the results obtained on mixing with ground linseed cake were uncertain and equivocal. Nevertheless, they acted as a control to the experiments quoted above, and proved that the effects noted there are due chiefly to the pepsin, and only partially to the dilute hydrochloric acid.

Feeding Experiments with Animals.

Through the kindness of Professor T. W. Cave, F.R.C.V.S., by whom the experiments were carried out, feeding trials with guinea pigs and sheep were instituted in order to determine (*a*) whether the cyanogenetic glucosides themselves are toxic or capable of producing hydrocyanic acid by the action of enzymes present in the digestive organs, and (*b*) whether linseed cake of high "free" prussic acid content can induce poisoning under known conditions.

Experiments with Cyanogenetic Glucosides.—For these experiments amygdalin and phaseolunatin were used, and fed to guinea pigs. Taking as an average a guinea pig of 1½ lb. weight, then weight for weight a lethal dose of prussic acid should be 1/93 of the human lethal dose, which is generally taken at 1 grain.

Owing to the difficulty of inducing animals to take solutions of glucosides, weighed quantities of the latter were absorbed into separate lots of 3 grams of bran, which were dried and fed to the animals.

Starting with quantities of amygdalin and phaseolunatin corresponding to two lethal doses of prussic acid, the amounts were gradually increased, with intervals of two or three days' "rest" between increments, up to twelve lethal doses without any effect whatsoever. The heaviest doses amounted to 0·33 gram amygdalin and 0·15 gram phaseolunatin respectively. Calculated for a sheep (126 lb.) on the same basis, this would be 26·4 grams amygdalin and 12 grams phaseolunatin; in the latter case as much glucoside as would be present in 7½ lb. of a linseed cake containing 0·4 per cent. of prussic acid.

It may be taken, therefore, that the cyanogenetic glucosides are not hydrolysed by the animals' digestive juices, and there is no fear of prussic acid being formed from a feeding stuff containing glucosides of this type if the enzyme is absent or previously destroyed.

Feeding Trials with Linseed Cake.—Experiments were carried out with two sheep tegs, A (Kent, weight 84 lb.), and B (Southdown, weight 50 lb.). Both were normal and in good condition. The cake used was that containing 0·052 per cent. of free prussic acid previously mentioned.

Sheep A.—Kept without other food, and received on successive days 1 lb. crushed cake, 1 lb. crushed cake, 2 lb. crushed cake, 3 lb. crushed cake moistened with water, 4 lb. crushed cake moistened with water. No results were noticed. The animal ate the cake readily, but in quantities over 4 lb. would not eat the whole ration.

Sheep B.—Kept without other food, and fed as follows:—

(1) Kept without food for twenty-four hours, and then given 1 lb. ground cake soaked with warm water for eighteen hours. This ration smelt very strongly of prussic acid. Animal started to eat and then refused, but eventually ate about one-third during nine hours. No definite result, but sheep was thought to look rather sickly. Remainder of cake removed.

(2) After a further lapse of one day fed 1 lb. soaked cake as in (1). Animal very hungry, but again refused the food.

(3) Kept for thirty-six hours without food, and then given 1 lb. ground cake soaked with water half an hour before use. The smell of prussic acid in this case was hardly so pronounced as in (1). Ration eaten fairly readily. After three hours given another 1 lb. of cake, which had soaked for six hours. This was partially eaten, but not so readily as the first pound. No definite result was obtained, but the sheep was distinctly sick in appearance.

Lethal Dose of Prussic Acid as Potassium Cyanide.—Sheep B.—Given, by mouth, 1·2 grams potassium cyanide. This is equivalent to 7·8 grains of prussic acid, the amount available from 2 lb. of the linseed cake previously used. The poison took effect in 30 seconds, and the sheep died within 3 minutes.

Sheep A.—Given, by mouth, 0·6 gram potassium cyanide, equivalent to 3·9 grains of prussic acid, the amount available from 1 lb. of linseed cake. Toxic symptoms were noticed after 90 seconds, and the sheep eventually died in 12½ minutes. In the latter experiment it seemed that the minimum lethal dose for the sheep was nearly reached. In this case the animal was given the cyanide after a full meal, whereas Sheep B had very little in its stomach.

It is noteworthy that Sheep B would not eat well-soaked cake which smelt strongly of prussic acid, even when kept without food for some time, whereas cake soaked in cold water shortly before use and giving less obvious evidence of the presence of prussic acid was taken more readily, and without fatal effect, although the animal showed symptoms of slight poisoning.

The conclusions drawn from the feeding experiments were that the prussic acid from linseed cake fed in the drv state is not rapidly generated in the animal's stomach, whereas soaked cake if eaten at once may well prove dangerous.

The lethal dose of prussic acid seems to be higher in ruminants than in man, yet Lander's figures (*loc. cit.*) obtained with a heifer seem rather too high, and argue a certain amount of accustomisation.

The main point made by the experiments, however, is the fact that the lethal dose for sheep can readily be reached with a linseed cake of fairly high prussic acid content, and weight for weight, one may argue the same to hold good for calves.

Conclusions.

From a due consideration of the results obtained, one must conclude that when properly administered, linseed cake may still be regarded as a perfectly safe feeding stuff. The actual amounts fed at a time are small. On account of its price and other considerations, linseed cake is generallv only used as a finishing material, and as one of a mixture of several concentrated feeding stuffs. As a rule this, in itself, is sufficient to bring the maximum amount of prussic acid which could be produced below the lethal dose for the animal fed. The practice also of giving at the same time bulky amounts of green fodder or hay most energeticallv inhibits the generation of the poison. Indeed, practically every circumstance is against the prussic acid. Salt, sugar, and other adjuncts to feeding all exert considerable influence in preventing its formation, and the animals' digestive juices, instead of themselves causing the liberation of prussic acid, as was feared, actually take an active part in its prevention.

The varied inhibition effects, and particularly that of the fodder-cellulose, may largely account for the fact stated by Hendrick that in the case of "Java" beans many tons of material were consumed without ill-effect. Indeed, material which had caused fatal poisoning in one place was fed to a dairy herd on another farm for several weeks without any evil results being noticed.

On the other hand, with the use as a feeding stuff of material capable of producing 4 grains of prussic acid per pound, it is obvious that a certain amount of care must be exercised, and fermented, mouldy, or yeast-containing foods should be avoided for use with linseed or linseed cake. The gravest chance of misadventure occurring, however, is in the preparation of linseed gruel, where the cake is fed wet. Gruel which has not been made with boiling water, and which has been allowed to stand some time before feeding, may well prove extremely dangerous, particularly if given to calves which are not in good condition, and is probably the cause of the few authenticated cases of poisoning which have occurred. Against this must be set the rather large amount of prussic acid or its equivalent in potassium cyanide which is necessary to cause death in herbivorous animals, but different animals will vary in susceptibility to the poison, and there is no evidence to show that a certain amount of accustomisation to prussic acid cannot be attained.

The fact that the cyanogenetic glucosides themselves are non-poisonous to ruminants, and that a linseed gruel in which the enzyme has been killed by heat is quite innocuous, is difficult to reconcile with the assertion of Guignard that "Java" beans, which contain the same glucoside, are poisonous, even after boiling, "since this process merely destroys the enzyme, and not the cyanogenetic glucoside."

The accumulated evidence of the feeding experiments carried out in this investigation and by Lander, seems to show that in normal cases the maximum amount of hydrocyanic acid actually formed from linseed cake is below that likely to cause death. Nevertheless, the total amount of free or available prussic acid (whether actually formed in the animal's stomach or not) may easily reach the lethal dose. It seems essentially desirable, therefore, that the amount of free prussic acid in a cake should always be measured, and, except that it might, in some cases, lead to distrust of a useful and harmless material, the quantity present should be stated along with the guarantee on the invoice. Cakes with more than 0·03 or 0·04 per cent. of free prussic acid should be used with caution, and any like those examined by the writer, which contain 0·05 per cent. or more of free prussic acid, should particularly be regarded with suspicion and carefully fed, despite the negative results obtained by feeding them to sheep.

THE FOOD OF NESTLING BIRDS.

WALTER E. COLLINGE, M.Sc., F.L.S., F.E.S.

It is a well-known fact that nestlings consume during the first few days of their life considerably more than their own weight of food per day, making a daily gain in weight of from 20 to even 50 per cent. During this period feeding commences before sunrise and continues until after sunset. The number of meals taken during this period is very large. Dr. Clarence M. Weed* records that in the case of the Chipping Sparrow (*Spizella socialis*) the total number of visits paid by the parent birds, bringing food, in a day amounted to nearly 200. Dr. S. D. Judd,† writing of the House Wren (*Troglodytes aëdon*) states "that nestlings are fed very frequently, and consume an enormous quantity of food, is well shown by a half-day's observation," made by him on June 17th, 1899. He watched the feeding of a brood of three. "The family was found housed in a cavity in a locust tree, and was transferred to a baking-powder can, which was nailed to the trunk of the tree four feet above the ground, a convenient height for observation. The young were about three-fourths grown." The mother wren made 110 visits in four hours and thirty-seven minutes. On the following day similar observations were made, and in three hours and five minutes the young were fed 67 times. Newstead‡ has also given details for the starling as follows:—

---

* Bull. No. 55, New Hampshire Agric. Exp. Stat., 1898.

† "The Food of Nestling Birds," *Year-book, U.S. Dept. Agric.*, 1900; pubd. 1901.

During fifty-five consecutive minutes ...	20 visits
Between 3.50 and 7.55 p.m.	25 ,,
During six and a-half hours	79 ,,
,, six and a-quarter hours	45 ,,

Thus, "during a total period of 17 hours, representing approximately the hours of one day during which food was collected for the young, 169 journeys were made to the nest." This is in all probability much under the average.

Our knowledge of the nature and amount of food consumed by nestling birds is as yet very meagre. The subject is an important one, for many birds that in the adult condition feed upon both animal and vegetable matter, feed their young almost entirely upon insects, worms, and slugs. Indeed, from the nature of the structure of the stomach of a newly-hatched bird it may be generally concluded that most birds (excluding aquatic and raptorial species) feed their young on soft food, which largely consists of insects, slugs, spiders, and worms.

The following observations have been made:—

(i) In the case of the starling and house sparrow, from behind a curtained window. Many of the birds alighted on the window-sill before entering their nest, or lodged upon the outside projecting beams beneath the roof. With the aid of a pair of field glasses (and more often without) the nature of the food could be quite easily made out;

(ii) from examination of the fæces of the nestlings; and

(iii) from an examination of the stomach contents of 179 nestlings of the starling, house sparrow, song thrush, and blackbird.

I.—FIELD OBSERVATIONS.

Starling (*Sturnus vulgaris*, Linn.).

Observations were made on May 11th, 12th, 18th, 19th, and 26th. On the first four dates the numbers of visits were counted for sixty minutes, and were as follows:—38, 36, 32,

---

‡ The Food of Some British Birds, *Supplement to the Journal*, Dec. 1908, p. 58.

28; a series of counts made on May 27th gave the following results:—28, 28, 27, 26, the average working out at 32·2 visits per hour. On May 11th the first visits commenced soon after 4 a.m., and continued until noon, when they became less frequent, and between 12.30 and 2.30 p.m. only about 25 visits were made. The number of visits again rose, and visits averaging approximately 26 per hour were made until 6 p.m., when the numbers became gradually less, and ceased at 7.50 p.m. Thus, presuming that for 12 hours of the day an average number of visits amounting to 25 per hour was maintained, and half that number during 4 hours, we have the enormous total of 350 visits paid to the nest by the parent birds.

On May 11th, 12th, 18th, and 26th, careful notes were made at different periods of the day of the nature of the food, and these are given below.

May 11th, 10.30 to 11.5 a.m.—Fourteen visits were made to the nest, food being brought on each occasion. This consisted of 5 slugs (3 *Arion hortensis*, Fér., and 1 *Agriolimax agrestis*, Linn.); 3 earthworms; 3 wireworms; 2 larvæ of the Great Yellow Underwing Moth (*Triphaena pronuba*, Linn.); a number of small beetles, too small to be identified, 3 larvæ of Crane Fly; 2 pieces of bread.

May 12th, 10.15 to 11.15 a.m.—Thirty-two visits were made to the nest by the parent birds, and food was brought on thirty-one occasions. The following were identified:—18 larvæ of the Great Yellow Underwing Moth (*Triphaena pronuba*, Linn.), 16 slugs (12 *Arion hortensis*, Fér., and 4 *Agriolimax agrestis*, Linn.); 8 small earthworms; several small beetles; 2 spiders, 3 wireworms; a number of Dipterous larvæ.

May 18th.—At various times of the day fifty-two visits were observed, at each of which food was brought to the nest. The following were identified:—4 weevils (*Barynotus obscurus*, Fabr.); 3 wireworms; 15 larvæ of the Great Yellow Underwing Moth; many small Geometrid larvæ; 4 larvæ of Crane Fly; 4 earthworms; 10 slugs (*Arion hortensis*, Fér.); 2 pieces of meat.

May 26th.—Forty-eight visits were observed. The following food was identified:—6 large Noctuid larvæ; 8 larvæ of

Crane Fly; 4 wireworms; number of small beetles; 11 slugs (8 *Arion hortensis*, Fér.; and 3 *Agriolimax agrestis*, Linn.); 3 earthworms; 2 spiders; bread and kitchen garbage on 5 occasions.

Thus on 146 visits the following food was conveyed to the nest:—61 insect larvæ; a large number of small beetles; 18 earthworms; 42 slugs; 4 spiders; and various Dipterous larvæ, bread, &c. The whole fairly represents the food collected during the period of half a day.

House Sparrow (*Passer domesticus*, Linn.).

The numbers of visits were counted for periods of sixty minutes on May 12th, 18th, 26th, and 27th, and were as follows:—20, 22; 18, 20; 20, 22; 20, 22, the average working out at 20·2 visits per hour. The visits on one day commenced just after 4 a.m., and continued until 7.30 p.m. The number of visits daily is probably something between 220 and 260.

Observations were made on various dates of 84 visits to the nest, and the following were identified:—12 larvæ of the Winter Moth (*Cheimatobia brumata*, Linn.); 15 beetles (*Phyllobius*, sp.); 3 ladybird beetles; large number of small Dipterous larvæ; number of small Dipterous flies; 2 spiders; on 23 occasions bread, potato, and other kitchen refuse.

Song Thrush (*Turdus musicus*, Linn.).

Observations made on the number of visits paid by the parent birds to the nest during four consecutive hours gave the following results:—22, 24, 18, 15.

Blackbird (*Turdus merula*, Linn.).

A similar count to the above was made on five different occasions, extending over one hour each. The numbers of visits were 26, 24, 20, 22, 20.

II.—EXAMINATION OF FÆCES OF NESTLINGS.

Large quantities of the encapsuled fæces of young starlings were collected and subjected to careful examination. The results obtained are of interest in that they confirm the observations made on the nature of the food brought to the nest by the parent birds.

The fæces collected and examined during the first ten days gave but poor results, and would seem to point to the fact that worms, slugs, and quite soft food formed the bulk of the food during that period. The following materials were identified:—5 wing cases of beetles; 8 pieces of wings of some Dipterous insect; 14 heads of Lepidopterous larvæ; 1 remains of wireworm.

The fæces collected and examined later showed the following remains:—1 wing case of ground beetle (*Pterostichus madidus*, Fabr.); 19 legs of various small beetles; 1 wing case of ladybird beetle; 23 wing cases of weevils; 27 heads of Lepidopterous larvæ; parts of 5 wireworms; half of centipede (*Geophilus longicornis*); fragments of plant remains; grit.

III.—EXAMINATION OF STOMACH CONTENTS.

The stomach contents of 179 nestlings have been carefully examined. These consisted of 94 starlings, 42 sparrows, 20 thrushes, and 23 blackbirds.

It is unnecessary to set forth in detail the contents of each individual stomach, and the contents of each species are therefore summarised as follows:—

Starling.—94 examples:—

May 20th.—Twenty specimens received. The food contents identified were: 8 larvæ of the Great Yellow Underwing Moth; 8 larvæ of the Winter Moth; 9 small Lepidopterous larvæ; parts of 5 wireworms; wing cases and legs of 3 beetles; few small Dipterous larvæ; 3 spiders; remains of slugs; few pieces of earthworms; bread in all cases.

May 23rd.—Fourteen specimens received. The food contents identified were: 5 larvæ of the Great Yellow Underwing Moth; 8 small Lepidopterous larvæ; many small Dipterous larvæ; remains of 9 slugs (*Arion hortensis*, Fér.); few pieces of earthworms; bread and vegetable matter present in 12 cases.

May 25th.—Sixteen specimens received. The food contents identified were: 8 larvæ of Great Yellow Underwing Moth; 9 larvæ of the Winter Moth; 5 wireworms; 7 wing cases of weevils (*Barynotus obscurus*, Fabr.); few Fungus Gnats; 3 spiders; 2 centipedes; remains of 5 slugs; few pieces of earthworms; bread, meat, and vegetable matter present in 7 cases.

May 28th.—Twenty-two specimens received. The food contents identified were: 5 larvæ of the Great Yellow Underwing Moth; 7 small Lepidopterous larvæ; 8 wireworms; 11 wing cases of weevils (*Barynotus obscurus*, Fabr.); various small Dipterous flies; 2 spiders; 1 centipede; remains of 11 slugs (*Arion hortensis*, Fér.);

7 partly digested earthworms (*Allolobophora chlorotica,* Sav.); bread, meat and vegetable matter present in 15 cases.

May 29th.—Twenty-four specimens received. The food contents identified were: 6 larvæ of the Great Yellow Underwing Moth; 10 larvæ of the Winter Moth; 9 wireworms; wing cases, legs and other remains of 23 beetles; 3 spiders; 1 slug (*Arion hortensis,* Fér.); 9 earthworms (*Allolobophora chlorotica,* Sav.); bread, meat and vegetable matter present in 19 cases.

Sparrow.—42 examples:—

21 larvæ of Winter Moth; 3 small Lepidopterous larvæ; 19 wing cases of beetles; 7 wing cases of ladybird beetle; 33 wings of small Dipterous fly; 4 spiders; bread, meat, rice grains and vegetable matter present in 39 cases.

Thrush.—20 examples:—

1 larva of Noctuid moth; 3 wireworms; remains of earthworms and slugs in all cases; 4 spiders; vegetable matter and soil in all cases.

Blackbird.—23 examples:—

Remains of 17 earthworms and 9 slugs; 3 wireworms; fragments of wing cases of beetles; large amount of vegetable matter present in all cases; bread and grain present in 7 cases.

As has been pointed out by Dr. Judd,* practically all birds, excepting doves and pigeons, feed their young upon an animal diet, whatever may be the character of the food of the adult. Only continued observation will ultimately place us in possession of the nature and amount of food eaten by nestlings, and such information must ultimately prove of great value to all concerned with the raising of crops, whether fruit, general farm, or horticultural.

In conclusion, "it should be remembered that the nestling season is also that when the destruction of injurious insects is most needed, that is, at the period of greatest agricultural activity and before the parasitic insects can be depended on to reduce the pests." A knowledge, therefore, of the nature of the food, the amount consumed, and the relation this bears, from an economic standpoint, to the harm done by some species when adult, is no longer a question of interesting curiosity on the part of the bird-lover, but one that has a definite bearing on the success or failure of the produce of the land.

---

* *Op. cit.*, p. 435.

THE APHIDES ON MANGOLDS AND ALLIED PLANTS.

FRED. V. THEOBALD, M.A., F.E.S.

Professor of Agricultural Zoology (London University) and Vice-Principal, South-Eastern Agricultural College, Wye.

DURING 1911 a serious attack of Aphis was made upon mangolds, beets and other plants in several parts of the south-east of England, notably in East Kent, and a special investigation into the subject was carried out by the writer.

Four species of Aphides were found on mangolds and allied plants, the two commonest being *Aphis rumicis*, Linnaeus, and *Aphis atriplicis*, Linnaeus, while the other two are undescribed and are referred to here as *Rhopalosiphum betæ* and *Aphis brevisiphona*. Koch * and Kaltenbach † also record *Aphis ochropus*, Koch, as occurring on *Chenopodium* as well as on the Teasel (*Dipsacus*), but the writer was unable to find this species on any Chenopodiaceous plants in the south of England. By far the most harmful among the Aphides is the Black Dolphin (*Aphis rumicis*), sometimes called the "Collier," or Black Fly, and which has been described under a variety of names owing to the large number of its host plants. In 1909 Jablonowski ‡ published a good deal concerning the Aphides of sugar beet and mangold, mentioning *Aphis papaveris, rumicis, evonymi, chenopodii*, and *atriplicis*. As shown later, the three first and the two last are the same, *i.e.*, only two species are referred to. The complete life cycle of the Black Aphis (*A. rumicis*) does not appear as yet quite clear, but there is no doubt that it passes the winter in the egg stage on the Euonymus, where it hatches and becomes what is called *Aphis evonymi;* later it flies to poppies and becomes *Aphis papaveris*, and then, in certain years, when abnormal increase takes place, to mangolds, &c., returning to the Euonymus in autumn for the sexual stages.

At the same time there is another life cycle, for I have found *A. rumicis* ovipositing on the stalks of *Rumex*, often in considerable numbers, and also amongst the seedheads. The progeny of the last fly chiefly to beans. A black aphis also oviposits on gorse, but in the absence of winged specimens I am unable to say whether it is *Aphis rumicis* or the Aphis described by Fabricius as *A. ulicis*. I believe, however, that these are the same. With regard to *Aphis atriplicis*, the species appears to pass the whole of its life cycle on wild and cultivated *Chenopodiaceæ*. Nothing is known of the bionomics of the other species.

---

* *Die Pflanzenläuse Aphiden*, p. 128, 1857.

† *Die Pflanzen-Feinde aus der Classe der Insecten*, p. 505, 1874.

‡ *Die Tierischen Feinde der Zuckerrübe*, pp. 215–231, 1909. Budapest.

The life cycle plan given on page 473 shows the double method of living I have traced in Kent for *Aphis rumicis*, and which is probably universal.

THE BLACK, POPPY, BEAN, OR MANGOLD APHIS * OR "COLLIER" ("BLACK BLIGHT") (*Aphis rumicis*, Linnaeus).

General Description and Life History.

I have compared large numbers of the Black Aphis from broad beans, docks, mangolds, poppies, dahlias, and many other plants, and can find no structural differences, although they present various slightly diverse appearances when on the different plants, which are undoubtedly due only to food supply.

Thus the Dock Aphis (*rumicis*), the Bean Aphis (*fabae*), the Poppy Aphis (*papaveris*), the Dahlia Aphis (*dahliae*), the Black Mangold Aphis of Buckton (*atriplicis*), and the Euonymus Aphis (*evonymi*), are one and the same. Other names I append, as there seems no doubt that they are synonyms.

Osborn in 1894 showed that *rumicis* migrated in the autumn to

---

* *Aphis rumicis*, Linnaeus (Syst. Nat., 2, 734, 5 and 735, 16); *Aphis papaveris*, Fabricius (Ent. Syst., IV., 218, 38); *Aphis thlaspeos*, Schrank (Fn. Boic., II., 118, 1227); *Aphis fabae*, Scopoli (Ent. Carn., p. 139, n. 408); *Aphis atriplicis*, Fabricius (Ent. Syst., IV., p. 216); *Aphis aparines*, Schrank (Fn. Boic., II., 105, 1183); *Aphis armata*, Hausm. (Ill. Mag., I., 439, 30); *Aphis papaveris*, Kaltenbach (Mono. Pflanzenläuse, p. 82); *Aphis dahliae*, Mosley (Gard. Chron., I., 628); *Aphis hortensis*, Fabricius (Sp. Ins., II., 387, 26); *Aphis atriplicis*, Buckton (Mono. Brit. Aph., II., 81); *Aphis evonymi*, Fabricius (Ent. Syst., IV., 214, 21); *Aphis ulicis*, Fabricius (I have been unable in recent years to get any winged Aphis from *Ulex*, but in an old note I find I placed some taken at Esher in 1887 as *Aphis rumicis*); *Rumicifex*, Amyot (Ann. Soc. Ent. Fr., 2me Sé. V. 478); *Meconaphis*, Amyot (Ann. Soc. Ent. Fr., 2me Sé. V. 478).

Schouteden also places as synonyms with a query *Aphis aquilegiæ nigra*, Kittel, and *Aphis solani*, Kittel.

Walker (*List of the Specimens of Homopterous Insects in the Collection of the British Museum*, Part IV., p. 982, 1852) also places the following synonyms under *rumicis* (some are obviously wrong, a few may possibly be correct):— *Aphis atriplicis*, Linnæus (a distinct species); *Aphis craccæ*, Linnæus (distinct); *Aphis chenopodii*, Schrank (=*atriplicis*, Linnæus); *Aphis viciæ*, Fabricius (?); *Aphis genistæ*; Scopoli (a distinct species); *Aphis laburni*, Kaltenbach (distinct); *Aphis acetosæ*, Linnæus (distinct); *Aphis galii?*, Kaltenbach; *Aphis Galii Scabri*, Schrank (?).

Euonymus in America. Hayhurst (22) has also shown this to be the case on the same continent.

I have found Black Aphis ova on *Euonymus europaeus*, which hatched into Aphides—the true *Aphis evonymi*—and which became winged in late May and June, and left the spindle trees, practically all having gone by the end of June. These winged females I found producing colonies of living young in great numbers on wild and cultivated poppies in the neighbourhood. The structure of the winged females on the Euonymus and of those on poppies was identical. Thus there is no doubt that in one way the invasion comes to poppies from the spindle trees; then when the Aphides have smothered the poppies they migrate again to mangolds, beets, onions, dahlias, and a host of other plants. Many die off, but on certain plants, like mangolds and other *Chenopodiaceæ*, they pass through the normal stages, and later fly back to produce sexuparæ on the Euonymus.

The oviparous stage also takes place on the dock (*Rumex*), and, as far as I have followed it, the winged progeny from the docks mainly go, not to poppies, but to broad beans, and these become the *Aphis fabae*, and spread from beans to beans until the summer, when they go back to the *Rumex*. Some from Euonymus may go to beans, but this point I have been unable to settle. Nevertheless, winged females taken from Euonymus and put on beans in my garden produced the bean black fly (*A. rumicis*), just as they did on poppies naturally.

Food Plants of Aphis rumicis (Linnaeus).

I have found this Aphis on the following plants :—

Poppies.—The garden poppy (*Papaver somniferum*), the field poppy (*P. rhoeas*), the rough poppy (*P. hybridum*), the long-headed poppy (*P. dubium*), the Welsh poppy (*Meconopsis cambrica*), and the yellow sea poppy (*Glaucium luteum*).

Polygonaceae.—Curled dock (*Rumex crispus*), broad-leaved dock (*R. obtusifolius*), red veined dock (*R. sanguineus*), sorrel dock (*R. Acetosa*), sheep sorrel (*R. Acetosella*), *R. conglomeratus*, *R. pulcher*, and *R. hydrolapathum*. Also on rhubarb.

Chenopodiaceae.—Many-seeded goosefoot (*Chenopodium polyspermum*), white goosefoot (*C. album*), wild beet (*Beta maritima*), and on the cultivated red beet, sugar beet, and mangold; on *Atriplex patula*, the common Orache, *Atriplex hortense* (Houard).

Fumariaceae.—The common fumitory (*Fumaria officinalis*), the yellow corydal (*Corydalis lutea*), and *Fumaria muralis*.

Celastraceæ.—The spindle tree (*Euonymus europaeus*) and *E. verrucosus*.

Papilionaceae.—The yellow pea (*Lathyrus Aphaca*), the everlasting pea (*L. sylvestris*), and the broad bean (*Vicia*).

Liliaceae.—The onion (*Allium cepa*), the leek (*A. porrum*), and chives (*A. schoenoprasum*); and on asparagus.

Scrophulariaceae.—The foxglove (*Digitalis purpurea*).

Compositae.—Spear thistle (*Carduus lanceolatus*), marsh thistle (*C. palustris*), the creeping thistle (*C. arvensis*), and the meadow thistle (*C. pratensis*), the latter frequently smothered by it.

Cannabaceae.—The hop (*Humulus lupulus*).

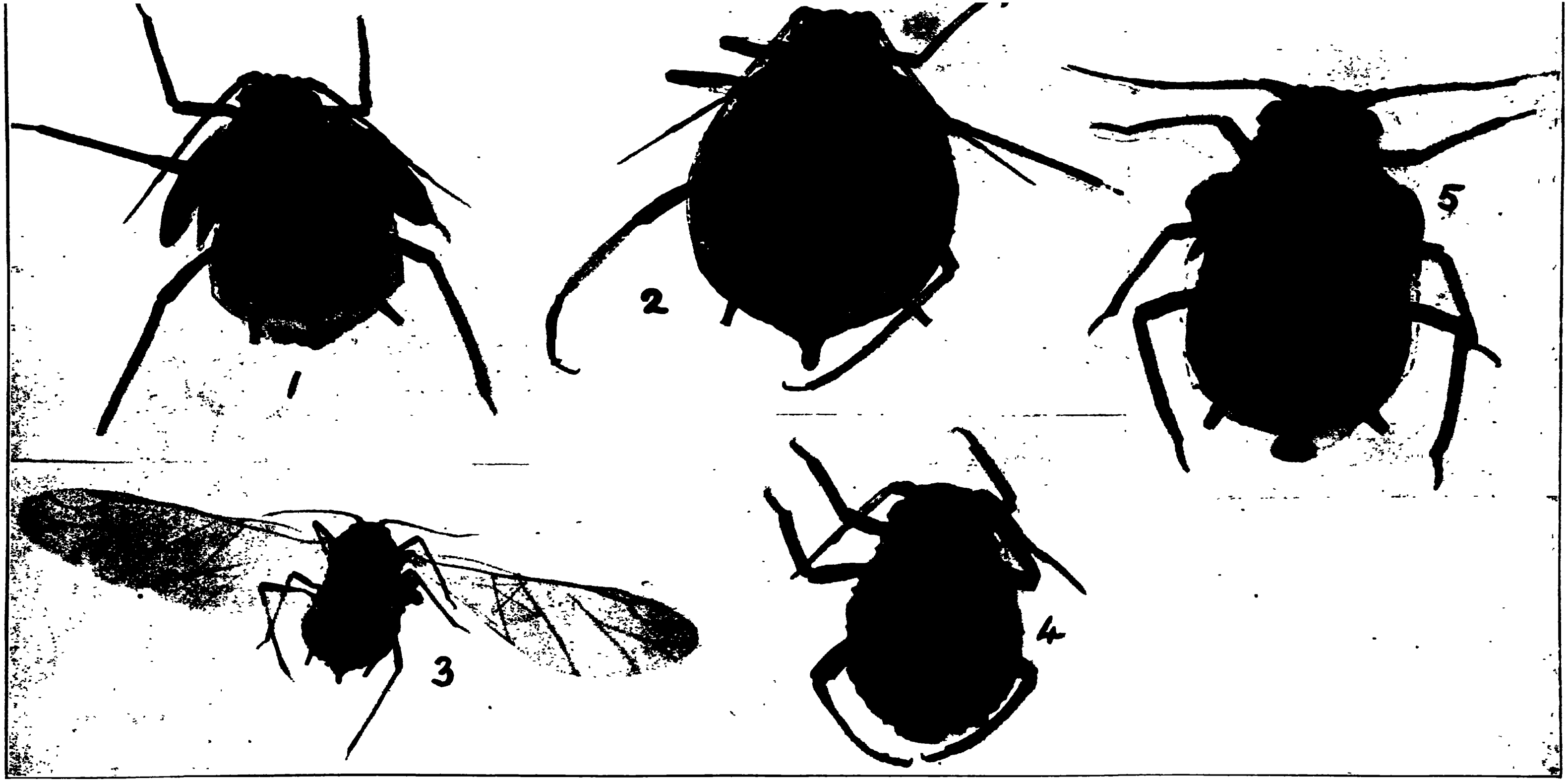


PLATE I.—Figs. 1, 2 and 3 : Nymph, apterous female and alate female of *Aphis rumicis*, Linnaeus.
Figs. 4 and 5 : Larva and nymph of *Aphis brevisiphona*, nov. sp. (note the shorter and thicker cornicles).

Also on ivy, holly, borage, garden marigolds, nasturtiums, chamomile, and gorse. I have never found it on the teasel, but Gillette records it on Dipsacus from Sussex, and also on the Burdock (*Arctium Lappa*) in America. I have specimens from the Pimpinel (*Pimpinella magna*) and from the Pimpernel (*Anagallis arvensis*). I have also a record from *Galium* (sp.?), and Curtis records it from turnips ("Farm Insects," p. 68). Schouteden (21) also records as food plants *Euonymus europaeus*, *E. maaki*, *Artemisia vulgaris*, *Solanum officinale*, *S. Dulcamara*, *Conium album*, and *C. maculatum*.

Damage Caused by Aphis rumicis.

The method of attack and the resulting damage differ considerably according to the host plant.

On docks it causes the leaves to curl downwards, often to such an extent that the insects are completely hidden. It has just the same effect after a while on the mangold, beet and sugar beet, but the leaf-curling takes much longer than on docks. On the poppy and broad and French bean it infests the stems. It also swarms over the unopened blossoms of the first-named, and I have seen large beds of Shírley Poppies killed by it. On broad beans it mainly infects the young top growth, and then as it increases it spreads downwards and gets on to the under-surface of the leaves and over the young pods, which it frequently destroys. On onions and leèks it settles on the tops of the leaves, which it kills and then dies away. On chamomile it clusters on the flower stalks. On hops it was found to collect in small, round masses, the young collecting around the winged females and causing pale, circular areas to appear on the leaves above. It does not seem, however, to flourish on hops, and in ten days or so dies off, as it does on the onion. Some years ago (1904) some growers, however, informed me that it was harming the hops.

Although it may be found on a very large variety of plants, the only ones I have seen it do any harm to are the following (arranged according to the amount of damage done): Broad beans, mangolds, beet, sugar beet, dahlias, poppies, French beans, peas, onions and leeks. It is best known as a bean and mangold pest, and in the garden is a serious enemy of the poppy. On rhubarb it was only found to occur on the flower-heads, causing them to turn brown.

Curtis (*Farm Insects*, p. 68) records it as destroying the turnip crop in Yorkshire to a great extent in 1854. Those I found in 1911 curled up the turnip and swede leaves just as they did the mangold leaves.

Damage Caused to Mangolds and Beets.—In 1904 Mr. Hammond, of Canterbury, informed me on July 23rd that the late wurzel crops round there would be very much damaged by Black Aphis unless rain was experienced very soon. Many other parts of E. Kent also suffered, and much harm was done at Wye to mangolds and some sugar beets. In 1911 several farmers in Thanet and one at Bromley wrote complaining of the enormous damage caused by the Black Dolphin. In consequence I visited a large area in Thanet and from there to Faversham, and found the mangolds in many cases so badly damaged that unless they were cleared of the blight by natural or artificial means little weight of crop could result. At the same time it occurred in vast numbers across the county through Canterbury to Dover. Several bad attacks were seen on Romney Marsh and through the Ashford-Maidstone valley. In 1904 the crop recovered as a result of heavy rains, but in 1911 the Aphides did much more damage and materially lessened the yield, but in no case could I find a crop actually ruined. In the same year information was also sought from Hunts, Essex, and Herts.

Foreign Distribution.—The Black Aphis (*Aphis rumicis*) is widely spread over Europe, being recorded from Italy, France, Germany, Belgium, Sweden and Holland. I also found it on several plants in Norway in 1880. It also occurs in North America.

Migration ("Blights") of the Black Fly.—Two large migrations of this Aphis have come to my notice. The first was in 1904,* when, in July, enormous numbers appeared in Kent. I identified it from Buckton's *Monograph of British Aphides* as *Aphis atriplicis,* Linn., and so recorded it. It was, of course, not that species, but *Aphis rumicis* which he had redescribed as the *atriplicis* of Linnaeus (in part). At that time I could not trace the origin of the plague.

In the immediate vicinity of Wye the winged females moved in a mass, smothering everything along one side of the valley

---

* *Report on Economic Zoology for the Year ending April 1st,* 1905, pp. 44-47, F. V. Theobald (1905).

PLATE II.—Broad Bean thickly encrusted with *Aphis rumicis*.

and then as suddenly stopped, and on the next morning the opposite side of the valley was visited in the same way.

Last year (1911) the migration was far greater and spread over a much wider area in Kent, most of Thanet and East Kent being covered, and from thence to Sevenoaks in decreasing amount. Moreover, the migration lasted over a much longer period, ranging from July 3rd to July 25th.

As in the previous instance, all kinds of plants were smothered by it, but mangolds and poppies in both instances were most affected.

It is strange to note that we get an annual invasion of poppies and broad beans and yet only occasionally this vast increase when the migrants cover all kinds of plants and remain and breed in such numbers on the mangolds and beets.

This year (1912) I have not been able to find any on mangolds and but few on poppies. Here and there, beans and docks have been attacked to some extent.

In 1904, although I did not actually trace the migrant's host plant, I suspected the red poppy, which was then in abundance in many fields on the chalk. In 1911 I clearly traced the migration at Wye from a large mass of Shirley poppies at the College, and from the millions of wild poppies along the Thanet coast. In both cases the poppies were killed long before they had flowered in many cases, and then winged hordes arose and migrated *en masse*. They produced their living young on all plants, but the young flourished only on mangolds, beets, dahlias and sugar beets, in addition to the normal host. In May I found colonies of a black Aphis, which I have recorded as *Aphis evonymi*, on the spindle trees (*Euonymus europaeus*) in this neighbourhood, and on comparing them with the winged and wingless females on the poppies I found them the same.

It thus appears that the "Black Blight" partly originates from the spindle tree, passes to poppies, and then on to mangolds, &c., and in a second way originates from the winter eggs on docks, and possibly from the gorse; the latter means of infection is, however, not settled.

Curtis (*Farm Insects*, p. 387) also records a great migration during the summer of 1847. He says, "the prodigious swarms of Aphides which suddenly covered the young shoots and the under sides of the leaves of almost every plant, so that the surface was blackened by them, was unprecedented, as far as can be ascertained, and it excited the attention of the public generally."

In a footnote he states that he considered the species *Aphis fabæ*, and Walker held the same opinion.

Description of Aphis rumicis, Linnaeus.

Apterous viviparous female.

Globular, deep velvety or shiny black, now and then inclining to deep olive green. Eyes dark. Antennæ variable in length and in number of segments; the fourth segment is usually a little shorter than the third, and the fifth a little shorter than the fourth; but now and again there are only five segments, the third being as long as the fourth and fifth; a single sensorium at apex of the fifth; black, but yellowish in the middle. Legs black, but the tibiæ and bases of femora pale.

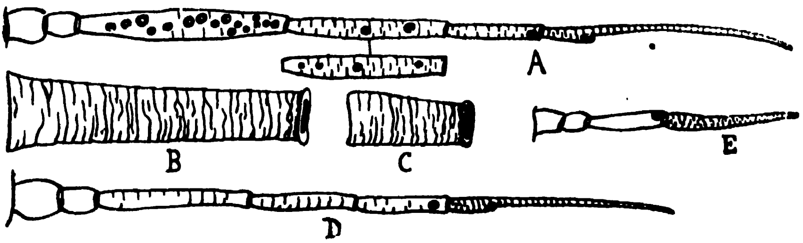


FIG. 1.—APHIS RUMICIS (LINNAEUS).

A. Antenna of alate female. B. Cornicle of alate female. C. Cornicle of larva. D. Antenna of apterous female. E. Antenna of larva.

Spines on prothorax and some abdominal segments.

Some may be found covered with a slaty-coloured meal; others are quite shiny.

Nymph.—Black and slatey-grey, the abdomen with four or five white downy patches on each side, and others below them, irregular in number, size, and arrangement.

Wing cases, black; eyes, black; cornicles and cauda, black.

Legs dark, with pale femoral bases and tibiæ.

The third antennal segment longer than fourth, the fourth a little longer than fifth, the latter with a single sub-apical sensorium, the segments imbricated. Cauda short, the hairs curved inwards at their apices.

Winged viviparous female.

Black to brownish black, the abdomen sometimes deep olive green with five black lateral spots and darker cross-bars; rather shiny. Antennæ black, but paler in the middle; the third segment with from eleven to nineteen sensoria; the fourth segment with one to five sensoria, slightly shorter than the third; the fifth shorter than the fourth, and with a sub-apical sensorium, the segments all imbricated.

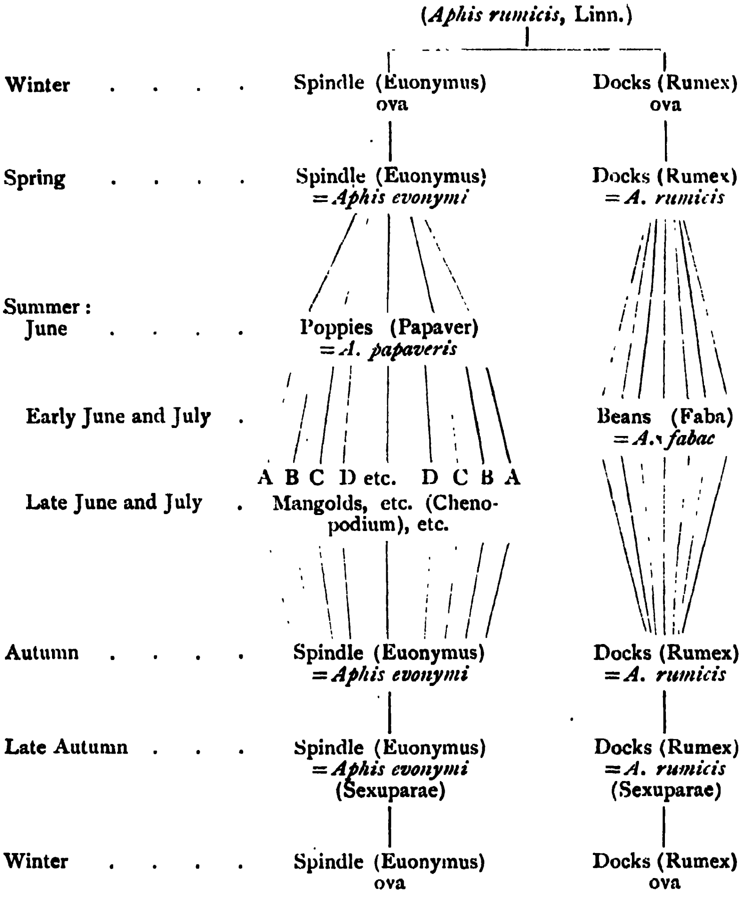
Legs black, with pale tibiæ and bases of femora.

Cornicles stout, rather short, broadest at the base, black and strongly imbricated.

Cauda partly black at the sides and apex, rounded and rather short, with numerous curved bristles.

Prothorax and abdomen with lateral spines.

LIFE CYCLE OF THE "COLLIER" OR BLACK FLY.



A = *Aphis atriplicis*, Buck. B = *Aphis dahliae*, Mosl.
C = *Aphis aparines*, Schrk. D = *Aphis hortensis*, Fabr., etc.

Length, 2 mm.

The *oviparous females* are wingless.

The *winged males* are dark blackish-brown.

A number of varieties occur as regards colour, but they are all dark in appearance. There is a difference easily noticed in the specimens from various host plants, in colour, size, and in the mealy nature of the integument, but when they are mounted in balsam, no structural difference can be detected.

Variation in Antennal Sensoria.—In examining microscopic preparations of the Black Aphis treated here as *rumicis*, considerable variation is found in the number of the sensoria on the antennal segments three and four, the number varying from 11 to 19 on segment three, and from 0 to 4 on segment four. Variation is also noticed in the two antennæ on the same insect. This variation is evidently partly only apparent owing to the different positions in which the antennæ lie when mounted. The following are a few counts made with the host plants upon which the insects were found:—

Host Plant.	Date.	Seg. 3.	Seg. 4	Locality.
Poppies	7/7/11	19—18	1—1	Wye
,,	7/7/11	15—15	0—0	Wye
,,	7/7/11	13—13	3—1	Wye
,,	4/7/11	13—10	0—0	Herne Bay
Mangolds	4/7/11	13—13	0—0	Herne Bay
,,	4/7/11	17—11	0—0	Herne Bay
Ornamental Spinach	7/7/11	16-18	3-0	Wye
,,	7/7/11	13—?	4—?	Wye
,,	7/7/11	14—12	2—1	Wye
,,	7/7/11	19-16	1—?	Wye
,,	7/7/11	18—18	0-0	Wye
,,	7/7/11	16—14	2-1	Wye
Chenopodium sp. ?	7/7/11	11—12	0—0	Wye
,,	7/7/11	12-14	1—0	Wye
Heracleum spondylium	4/7/11	13—14	2—1	Wye
Valerian	11/;/11	13—13	3—?	Wye
Pimpinella	15/7/11	13—14	0—2	Herne Bay
,,	15/7/11	15—?	0—?	Herne Bay
,,	15/7/11	13—13	0—0	Herne Bay
Atriplex patula	17/7/11	14—15	0—0	Hereford
,,	17/7/11	16—?	0—?	Hereford
Euonymus	9/6/11	19-17	1—1	Wye
Rhubarb	25/6/11	18—17	0—0	Wye
Onions	/7/04	14—16	0—0	Wye

REFERENCES.

(1) ***Linnæus, C. von.***
Syst. Nat. II. 734. 5, Faun. Suec. 979 (1746) (*rumicis*); Syst. Nat. II. 734. 6 (1767) (*acetosæ?*); Syst. Nat. II. 735. 13 (1767), Faun. Suec. 986 (*craccæ ?*) (1767).

(2) ***Bonnet, C.***
D'Hist. Nat. I. 6 (1779) (*rumicis*).

(3) ***Fabricius, J. C.***
Sp. Ins. II. 385. 11 (1781), Mant. Ins. II. 315. 12 (1787), Syst. Ent. 735, 10 (1775), Ent. Syst. IV. 213. 12 (1794); Syst. Rhyn. 296. 12 (1803) (*rumicis*); Gen. Ins. 303 (1776), Sp. Ins. II. 388. 33, Mant. Ins. II. 316. 68, Ent. Syst. IV. 218. 38, Syst. Rhyn. 299. 38 (*papaveris*); Syst. Ent. 735. 8, Sp. Ins. 385. 9, Mant. Ins. II. 315. 10, Ent. Syst. IV. 212. 10, Syst. Rhyn. 295. 10 (*aparines*); Sp. Ins. II. 387. 26, Mant. Ins. II. 316. 31 (*hortensis*); Ent. Syst. IV. 217. 31, Syst. Rhyn. 298. 31 (*atriplicis*, Linnæus); Syst. Ent. 736. 14 (*evonymi*); Sp. Ins. II. 389. 43, Mant. Ins. II. 317. 48, Ent. Syst. IV. 220. 49; Syst. Rhyn. III. 286 (*acetosæ*).

(4) ***Gmelin, J. F.***
Ed. Syst. Nat. I. 2203. 5 (*rumicis*); I. 2202. 36 (*papaveris*); I. 2210. 67 (*fabæ*); I. 2208. 59 (*aparines*); I. 4. 2204. 42 (*hortensis*); I. 2203. 6 (*acetosæ*); I. 2205. 13 (*craccæ?*).

(5) *Schrank, F. d. P.*
Faun. Boic. II. 1. 111. 1204 (1799) (*rumicis*); II. 1. 118. 1223 (*papaveris*); II. 1. 105. 1183 (*aparines*); II. 118. 1227 (*thlapseos*); II. 108 (*evonymi*); III. 119 1231 (*craccæ?*).

(6) *Scopoli, J. A.*
Ent. Carn. 139. 408 (1763) (*fabæ*); Ent. Carn. 407. 12 (1763) (*craccæ?*).

(7) *Turton, W.*
Ed. Syst. Nat. II. 703 (1806) (*rumicis*); II. 707 (*papaveris*); II. 710 (*fabæ*); II. 708 (*acetosæ*).

(8) *Rossi, P.*
Faun. Etrusc. 263. 1392 (1790) (*papaveris*).

(9) *Dufour, L.*
Réch. sur les. Hemipt. IV. 242. pl. 9. fig. 114. 115 (1833) (*papaveris*).

(10) *Fonscolombe, B. d.*
Anns. Ent. Soc. Fr. X. 162. 2 (*papaveris*).

(11) *Kaltenbach, J. H.*
Mono. Pflanz. 81. 58 (*rumicis*); 82–83 (*papaveris*); 46. 32 (*aparines*); 79. 80 (*evonymi*); 86. 62 (*craccæ?*).

(12) *Passerini, G.*
Aphid. Ital. 33 and 46. 37 (*rumicis*); 32 and 45. n. 36 (*papaveris*).

(13) *Walker, F.*
Ann. Nat. Hist. Ser. 2. V. 17. 73 (*rumicis*); List. Homopt. B. M. IV. 981 (1852) (*rumicis*); Zoolog. VI. 2247. 2249, VII. App. xxxiv. xlix. li. lii. (*rumicis*); List. Homopt. IV. 982 (*papaveris*); List. Homopt. IV. 982 (*aparines*); List. Homopt. IV. 982 (*armata*); List. Homopt. IV. 982 (*acetosæ*).

(14) *Kirby, W., and Spence, W.*
Intro. Ent. I. 175 (1826) (*fabæ*).

(15) *Bingley, W.*
Hist. Nat. III. 189 (*fabæ*); Ani. Biogra. IV. 5th ed. 78 (*fabæ*) (1820).

(16) *Curtis, J.*
Journ. Roy. Agri. Soc. VII. 418. pl. R. f. 21. 22 and X. pt. 1. pl. U. fig. 1–4 (*fabæ*); Farm Insects, 357. 387. 428 (*fabæ*); Farm Insects, 68 (*rumicis*).

(17) *Hausmann.*
Illigers. Mag. I. 439. 30 (*armata*).

(18) *Ferrari, P. M.*
Aphid. Liguriæ. 71 (*rumicis*).

(19) *Buckton, G. B.*
Mono. Brit. Aphid. II. 81–86 (*rumicis*); 87–90 (*atriplicis* part), 91–92 (*papaveris*); 72–73 (*evonymi*). (1879.)

(20) *Mosley, Sir Oswald.*
Gardener's Chron. I. 747 (*rumicis*); Gard. Ch. I. 628 (*dahliæ*).

(21) *Schouteden, H.*
Cat. d. Aphides de Belg. Mem. d. l. Soc. Ent. Belg. XII. 226 (1906) (*rumicis*); Avellino. t. 2. p. 92 (1903); Ann. Soc. Ent. Belg. t. 47. p. 170 and 190 (1903).

(22) *Hayhurst, P.*
Anns. Ent. Soc. America. II. 11. 97–98 (*rumicis*).

(23) *Mordwilko, A.*
Horae. Russ. Ent. Obsch. XXXI. 271 (*rumicis*). 1899.

(24) *Theobald, F. V.*
The Entomologist, XLIV. 19 (1911) (*rumicis*); Entomologist (1912) (*evonymi*); Rep. Eco. Zool. ending April 1, 1905 (deals with *rumicis* and *atriplicis*), pp. 44–47 (1906); Report Eco. Zool. ending April 1, 1907. 104–107 (1907), First Rep. Eco. Zool. B. M. 10 (1903) (*rumicis–atriplicis*). Rep. Eco. Zool. year ending September 30, 1911, p. 75–80 (1912).

(25) *Amyot, C. J. B.*
Anns. Ent. Soc. Fr. 2me. Sér. V. 478 (*Rumifex*); Anns. Ent. Soc. Fr. 2me. Sér. 478 (*Meconaphis*); Anns. Ent. Soc. Fr. 2me. Sér. V. 478 (*Craccifex*?). (1843.)

(26) *Ormerod, E. A.*
Manu. Inj. Ins. 3 (*rumicis* and *fabæ*) (1890).

(27) *Koch, C. L.*
Die Pflanz. Aphiden. 140 (*rumicis*); 130 (*papaveris*); 120 (*evonymi*) (1857).

(28) *Trotter, A.*
Zoocecidii della Flora Mantorana, Sec. Co. Atti Soc. Nat. Mat. t. 16. p. 32. No. 60.

(29) *Loiselle, A.*
Les Cécidies des environs de Lisieux, Bull. Soc. Hortic. Bot. Centre Normandie, p. 6. 1903.

(30) *Tavares, J. d. S.*
Ann. Sci. Nat. Porto. t. 7. p. 83. No. 147 (1900), Synopse das Zoocecid las Portuguezas. Broteria. Lisboa. t. 4. pp. 3 and 6 (1905) (*rumicis*); pp. 24 and 90 (*papaveris*); Zoocecidias novas para a fauna Portugueza. Broteria. Lisboa. t. 2. p. 161. No. 3 (1903); Broteria, S. Fiel. t. 6. Serie Zoologica, p. 110 (1907).

(31) *Mariani, G.*
Atti. Soc. Ital. Sci. Nat. t. 46. p. 309. No. 134 and 311. No. 145 (1907) (on *Rheum*).

(32) *Kieffer, J. J.*
Synopsis des Zoocécidies d'Europe, Ann. Ent. Soc. Fr. t. 70. p. 484 (1901).

(33) *Marchal, C., and Chateau, E.*
Catalogue des Zoocécidies de Saône et Loire, Mém. Soc. Hist. Nat. t. 18. p. 295 (1905).

(34) *Hieronymus, G., and Pax, F.*
Herbarium Cecidologicum, Fasc. XV. No. 422 (1907).

(35) *Cecconi, G.*
Quinta contribuzione alla conoscenza della Galle Foresta di Villombrosa, Malpighia, Genova. t. 15. p. 263. No. 8 (1901).

(36) *Houard, C.*
Les Zoocécidies des Plantes d'Europe, et du Bassin de la Mediterranée, 1909.

(37) *Ross, H.*
Die Pflanzengallen Mittel- und Nordeuropas, 1911.

IMPORTS OF GRAIN IN THE CEREAL YEAR 1911–12.

The extent to which this country has been dependent on the Colonies and foreign countries for grain to supplement the harvest of 1911 may conveniently be considered at the end of the cereal year (September 1st to August 31st).

The imports of wheat into the United Kingdom amounted to 24,109,260 qr. (of 480 lb.), a quantity which exceeded the import of the preceding year by 593,120 qr., and which has only once been exceeded. Including the produce of the home wheat crop of 1911, and converting the imported flour into an equivalent quantity of wheat, the total quantity of wheat available for consumption in the United Kingdom was 35,472,600 qr., compared with 33,854,000 in 1910–11. In these amounts seed is included, but not stocks carried over. Similar figures for recent years are given in the following table:—

Harvest Year.	Wheat Crop of the United Kingdom.	Imports of Wheat during the Cereal Year Sept. 1–Aug. 31.	Imports of Wheat Flour in equivalent Weight of Grain.	Total Imported Wheat and Flour in equivalent Weight of Grain.	Total estimated Wheat Grain available for home consumption (including seed).
	Qr.	Qr.	Qr.	Qr.	Qr.
1903–4	6,102,300	21,723,820	6,203,350	27,927,170	34,029,470
1904–5	4,740,000	24,529,170	3,526,620	28,055,790	32,795,790
1905–6	7,541,600	22,063,580	4,677,330	26,740,910	34,282,510
1906–7	7,577,300	22,105,180	4,284,490	26,389,670	33,966,970
1907–8	7,066,400	21,362,720	4,339,090	25,701,810	32,768,210
1908–9	6,741,200	21,727,220	3,554,650	25,281,870	32,023.070
1909–10	7,899,600	24,099,060	3,501,520	27,600,580	35,500,180
1910–11	7,074,200	23,516,140	3,263,380	26,779,520	33,853,720
1911–12	8,039,200	24,109,260	3,324,140	27,433,400	35,472,600

With regard to the countries from which the supply of wheat was drawn, the receipts from each of the principal sources of imported wheat are given below:—

Country of Export.	Thousands of cwt.			
	1911-12.	1910-11.	1909-10.	1908-9.
India	21,468	21,460	16,077	10,904
Russia	8,520	25,728	27,911	9 470
Argentina	16,823	16,983	11,405	24,542
United States	16.619	9,479	14,911	19,299
Canada	19,819	13,826	18,539	15,118
Australia...	15,170	10,418	11,915	9,587

In 1910–11 there was a set-back to the steady increase shown by Canada in recent years, but in 1911–12 there was a recovery, and the imports from that country, 19,819,000 cwt., are the largest yet recorded. The imports from Australia, 15,170,000 cwt., were also the largest yet recorded from that country. The decreasing tendency exhibited by the United States up to last year was not maintained, the imports in 1911–12 being higher than in either 1910–11 or 1909–10. The imports of wheat from Argentina were much below the level of some former years, the decrease compared with 1907–8, for instance, being 11,305,000 cwt. The receipts from Russia were extremely low compared with those of the two previous cereal years. The supplies of Russian wheat have fluctuated greatly in the last ten years; from 1901–2 there was a steady increase until 1904–5, after which there was a gradual drop, until in 1907–8 the receipts from this source were only 4,455,000 cwt.; by 1909–10, however, the imports had nearly reached the total of 1904–5. An increasing proportion of the total imports of wheat in recent years has come from the countries of south-eastern Europe.

In spite of the fact that the supplies both of home-grown and imported wheat were larger than in 1910–11, the prices of both kinds show an increase compared with the prices of 1910–11. The average declared value of imported wheat was 35*s*. 11*d*. per qr., compared with 33*s*. 10*d*. in 1910–11, 37*s*. 5*d*. in 1909–10, and 39*s*. 1*d*. in 1908–9. English wheat averaged 34*s*. 10*d*. per qr., a rise of nearly 4*s*. over the price in 1910–11. During the year the price of English wheat rose steadily from 31*s*. 10*d*. in the first week of September, 1911, to 39*s*. 2*d*. in the second week of August, 1912. English barley averaged 31*s*. 2*d*. per qr. (a rise of 6*s*. 5*d*. over the preceding year), while English oats averaged 21*s*. 6*d*. (a rise of 3*s*. 10*d*.).

The following table shows the average prices of English wheat, barley, and oats ascertained under the Corn Returns Act in each of the cereal years since 1901. The quantities given in the table are the quantities returned as sold, from which the averages are calculated:—

Harvest years.	Prices per quarter.						Quantities sold at certain markets.		
Sept. 1–Aug. 31	Wheat.		Barley.		Oats.		Wheat.	Barley.	Oats.
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	Quarters.	Quarters.	Quarters.
1901–02 ...	28	4	25	11	20	4	2,451,275	3,176,599	698,840
1902–03 ...	26	5	23	4	17	8	2,386.017	3,151,337	1,104,660
1903–04 ...	27	2	21	10	16	4	2,129,448	2,780,473	1,132,086
1904–05 ...	30	7	24	6	17	0	1,746,927	3,141,058	1,178,154
1905–06 ...	28	9	24	2	18	5	2,940,263	3,202,613	940,015
1906–07 ..	28	1	24	5	18	4	2,830,991	3,376,615	1,219,419
1907–08 ...	32	9	25	8	18	2	2,944,256	3,504,908	1,530,848
1908–09 ...	36	6	26	11	18	10	2,962,825	2,972,889	1,054,318
1909–10 ...	32	6	23	10	17	8	3,141,873	2,988,483	795,824
1910–11 ...	30	11	24	9	17	8	2,799.763	2.992,128	831,898
1911–12 ...	34	10	31	2	21	6	2,944,995	2,645,477	719,495

The imports of flour compared with 1910–11 remained practically stationary, having, on the whole, been declining since 1900–1, when the quantity imported was 23,000,000 cwt. The United States formerly supplied almost the whole of the flour imported into this country, but side by side with a decrease in the supplies from that country the imports from Canada have steadily increased until the imports of flour from the latter—3,945,000 cwt.—are nearly equal to those—4,419,000 cwt.—from the United States.

The imports of both barley and oats were about 1,800,000 cwt. above those of 1910–11. Of the total quantity of barley available for consumption in the United Kingdom, on the average less than a half is imported, while of oats only about one-fifth is imported, and in the case of both these cereals there seems to be no tendency towards a permanent increase in the imports. The imports of maize dropped to a very low figure.

The aggregate imports of the principal cereals in each of the past eight years are given below:—

Harvest year.	Millions of cwt.				
	Wheat.	Wheat Meal and Flour.	Barley.	Oats.	Maize.
1911–12	103·3	10·3	21·9	18·4	32·1
1910–11	100·8	10·1	20·1	16·6	46·0
1909–10	103·3	10·8	19·9	19·6	34·6
1908–9	93·1	11·0	22·0	15·5	39·0
1907–8	91·6	13·4	17·5	13·2	39·5
1906–7	94·7	13·2	19·5	10·9	51·7
1905–6	94·6	14·4	20·3	16·0	47·1
1904–5	105·1	10·9	21·0	17·2	42·3

The Practical Value of a Soil Analysis.

Inquiries are frequently received by the Board from farmers and gardeners who wish to be informed where they can have soils analysed. In most cases the idea appears to be entertained that having a soil analysed is a ready means of determining its manurial requirements, or of obtaining an indication of its fertility. A brief discussion as to how far this view is correct may therefore not be out of place. Take, first, the broad question—to what extent does an analysis of a soil give an indication of that soil's fertility?

The fertility of a soil may be defined as its power of growing crops, and it is obvious that while this depends to a great extent on the soil's ability to supply the crop with what is often termed plant food—in particular, nitrogen, phosphate, and potash—in a suitable form, this is by no means the only essential condition. A sufficient and continuous supply of water to the roots, and proper aeration of the soil, are quite as necessary for satisfactory growth as the supply of manurial ingredients. To a very great extent these factors are regulated by circumstances of climate, exposure, drainage, and depth of soil, which obviously cannot be determined in the laboratory. Even if the analyst could give complete information about the plant food, and were able to measure accurately the mechanical condition (*i.e.*, texture) of the soil, and to correlate it exactly with the questions of aeration, drainage, and water supply, the information obtained in the laboratory could only give a very incomplete idea as to the fertility of any particular field, and the farmer would have to supplement it by his local knowledge, experience, and judgment.

Unfortunately, however, the analyst cannot at present give more than very rough and incomplete information even about those factors influencing fertility which lie within his province. Some of the difficulties with which he has to contend may be mentioned here. He can determine as accurately as need be the total amounts of nitrogen, phosphates, and potash in the soil, but it has been found that, even where external factors such as climate, depth of soil, &c., do not enter into the case, there is often little or no connection between these amounts and the soil's fertility or its manurial requirements. Any ordinary soil contains much more total plant food of all forms than a single crop of any kind can possibly require. Most of this plant food, however, is in an unavailable or locked-up condition, and is only gradually set free or made available, the rate varying in different cases. As the plant can only make use of the free or available food, it is easy to see that it is quite possible for one soil, containing quite small amounts of the manurial substances, to produce better crops than another soil containing large quantities, if for any reason the first soil gives up its material to the plant at a more rapid rate than the second. In fact, many soils contain very large quantities of, say, phosphates, and still respond most readily to small dressings of manures containing available phosphate, because practically all that is already in the soil is unavailable, and, as far as the plant is concerned, might almost as well not be there at all. (It may be remarked that exposure to air and weather, and treatment which secures a healthy condition of soil, are some of the factors which determine the rate at which plant food becomes available in the soil, so that, apart from their other important functions, good cultivation, draining, and liming may partly take the place of manuring in a soil which contains large stores of locked-up food.)

In the case of phosphates and potash, a method has been devised of roughly measuring the amount which may be regarded as of immediate or prospective value to the plant, by finding, not the total amount of phosphate or potash present, but the amount which is dissolved out in a given time by a weak solution of citric acid. This method gives results which in many cases indicate fairly well whether a particular soil will respond to applications of either of the two kinds of manure, and may be used in comparing soils of the same class. At the same time there are many cases where the results obtained are at variance with those obtained by actual experiment in the field. So far, no ready method has been discovered by which the availability of the nitrogen in the soil can be estimated except as regards the small amount present in the form of nitrates or of ammonium salts.

As already mentioned, two conditions essential for the satisfactory growth of crops are a sufficient supply of water and the proper aeration of the soil. To a great extent the ability of the soil to meet the plant's requirements in these respects is determined by the size and nature of the particles of which the soil is composed. By carrying out a "mechanical analysis," the proportions of particles of different degrees of coarseness can be measured, and as the results of such analyses accumulate, it will probably become possible to estimate from such an analysis such factors as water-retaining power, ease of drainage, ability to withstand prolonged drought, and so forth, and even to say with some degree of certainty what systems of cultivation are most likely to result in a good tilth at any particular time of year. At present, however, such an analysis is tedious and expensive, and in most cases an experienced farmer would be able to gain more useful and accurate information by walking over the land and examining it carefully at different times of the year.

On the whole, in the present state of our knowledge, it must be concluded (1) that chemical and mechanical analyses of soils are of little practical value except in a few special cases; (2) that an intelligent and experienced local farmer could give a much better idea of the fertility of any particular farm or field than an analyst; and (3) that as a means of determining the manurial requirements of a soil a simple field experiment gives more accurate and reliable knowledge than ordinary analyses.

In certain special cases, however, soil analyses may undoubtedly be of great practical value, *e.g.*, (1) by a very simple test, which most farmers could carry out for themselves, it is possible to say whether a soil is in need of liming or not; (2) if, by means of a Soil Survey, such as those now being carried out in many parts of the country, complete information has been obtained with regard to some special class of soil occurring in a limited area, different samples of that particular soil can be compared and classified fairly accurately, and their manurial and cultural requirements predicted with a considerable degree of certainty.

Damage to Oats by Fritfly.

The oat crop in 1912 will probably be much below the average. Reports received from nearly every part of England and Wales during the summer indicated that the prospects were "poor," "bad," "very bad," or "extremely bad." The drought of April and May was, of course, partly responsible for this state of things; but in many districts the condition of the crop in June and July was chiefly due to the ravages of the fritfly, which has been exceptionally prevalent. This pest, which is present among the oats nearly every year, takes an epidemic form in some seasons, spreading over certain districts, and causing serious loss. As a rule, it is most abundant in the counties lying about fifty miles north and south of the Thames Valley, but this year it was reported in nearly every county except Northumberland, Cumberland, Westmorland, Cornwall, and

Devon. It has caused the greatest injuries in the western and Midland counties. As usual, winter oats appeared generally to escape, while late sown oats and oats following roots were those most seriously attacked. In many places the fields were ploughed up, the crop being a failure.

Unfortunately the pest is not recognised by many farmers, who attribute the poor state of the plants to wireworm, or eelworm. Of course, eelworms may be present along with the frit larvæ; and eelworms alone, giving rise to "tulip root," can be very destructive. The failure to recognise the true cause of the injury leads many farmers to regard the insect with apathy and to neglect to take precautions which would render their crops less liable to attack in a subsequent season. Those, however, who realise the nature of the attack and are willing to adopt measures for combating the pest will find several ways of keeping it in check.

In the first place, the life-history of the insect must be noticed. Three generations are possible in a year. The flies of the first generation issue in April and May, and lay their eggs on the leaves of the young oat plants. When the maggots hatch they pass to the lower part of the plant behind the leaf sheaths. They burrow in and down the stem, feeding on the heart of the plant, and after a few weeks pupate there. In July the next generation begins to issue. These flies lay their eggs generally on wild grasses, but, if the grain is still young, in the ears of the oats. This form of attack is seldom noticed, as the larvæ are hidden under the cover of the glumes, but the result appears in the harvest in the shape of light samples, and gnawed, shrivelled grains. In August and September a third generation appears, and swarms of flies may be noticed in places where infested grain has been stored. The eggs are again laid on wild grasses, and the adult flies appear in the following year.

From this description it will be seen that the liability to attack can be greatly reduced by paying attention to the time of sowing. Winter oats, if not sown too early, have a reasonable chance of escaping attack. Spring oats, on the other hand, must not be sown late, as plants which have made considerable growth are seldom attacked. Stimulating dressings of nitrogenous fertilisers in the spring will help on the plants, and in some years traps may be made by sowing a small quantity of oats directly after an early harvest and ploughing the crops in with the aid of a skim coulter in early winter. By this means one generation of flies, or part of one, might be destroyed. In a year like the present such a course may not be possible, but in every case steps should be taken to destroy the flies that appear in granaries, stores, &c. Some years ago a correspondent sent to the Board some sheets of sticky fly-papers which were black with the bodies of the flies he had caught in a granary in his occupation. Finally, in deciding on the rotation of their crops, farmers should remember that it has been repeatedly observed that oats after roots are more liable to attack than after any other crop, perhaps because they are frequently late sown.

In the present year, in specimens received by the Board of Agriculture and Fisheries, fritfly larvæ were found at work on wheat.

The Dairy Produce of Great Britain.

The total quantity of milk produced in Great Britain in the year 1907–8, as ascertained from inquiries of the Board under the Census of Production Act, 1906, after allowing for calf-rearing, was 1,208,000,000 gallons, or an average yield per cow in milk of 550 gallons (or 437 gallons per head of the total number of cows and heifers).

The table on the next page shows the number of cows and heifers, the total quantity of milk produced, and the dairy produce sold on holdings of all sizes in Great Britain, in the twelve months ending July 4th, 1908.

More than one-fourth of the total number of milch cows in England are found, and nearly 28 per cent. of the total quantity of milk is produced, in the six counties of Cumberland, Westmorland, Lancashire, Cheshire, Derby, and Stafford.

Of the total quantity of milk produced 70 per cent., or 850,000,000 gallons, is sold by farmers as milk. It is not, however, all consumed as milk, a certain proportion being sold by the producers to creameries and factories and there made into butter or cheese. From the returns furnished to the Board of Trade from butter, cheese, and margarine factories and workshops (Cd. 5463), it appears that the butter and cheese made in Great Britain in such factories would represent about 23,000,000 gallons, without taking into account such quantity as may be used in the manufacture of margarine, artificial and imitation butter, and other products

	England and Wales.	Scotland.	Great Britain.
Cows and Heifers—			
In milk	1,833,079	364,684	2,197,763
In calf, not in milk	498,818	67,199	566,017
Milk Produced—			
Total ... ...gals.	1,028,951,000	179,427,000	1,208,378,000
Aver. per cow in milk ...gals.	561	492	550
Dairy Produce Sold –			
Whole Milk ... ...gals.	731,378,000	119,610,000	850,988,000
Cream ... ... qts.	2,915,000	3,004,000	5,919,000
Butter ... ... lb.	48,991,000	5,911,000	54,902,000
Cheese ... ... cwt.	386,000	113,000	499,000
Skim milk ... ...gals.	10,322,000	6,815,000	17,137,000

which, so far as whole milk is concerned, may perhaps be regarded as comparatively unimportant. The total quantity of whole milk actually sold off the farms for consumption was therefore, in round figures, about 800,000,000 gallons in 1908.*

The total quantity of butter sold by British farmers (not including that made in creameries or factories) † was 490,000 cwts. (54,900,000 lb.), representing about 140,000,000 gallons of milk or 12 per cent. of the total milk produced. The total quantity of cheese sold by farmers was 500,000 cwts., representing about 56,000,000 gallons of milk, or rather less than 5 per cent. of the total milk produced. Allowing for 5,900,000 quarts of cream sold, it appears that of the total quantity of milk produced about 90 per cent. is sold off the farms in one form or another. The remaining 10 per cent. represents the consumption by farmers and their households, including to some extent farm labourers, of milk, butter, and cheese.

---

* The imports of fresh milk into the United Kingdom in 1908 amounted to 953 cwt. = 10,460 gallons.

† The quantity of butter made or blended in butter factories, &c., in Great Britain was 422,000 cwt. (Cd. 5463). The imports of butter from Ireland to Great Britain in 1908 amounted to 751,942 cwt. (Cd. 4869).

The quantities and values of dairy products sold by farmers may therefore be calculated as follows:—

	Quantity.	Value.
	Gallons.	£
Milk (whole)	850,000,000	24,820,000
,, (skim)	17 000,000	143,000
	quarts.	
Cream	5,900,000	590,000
	cwt.	
Butter	490,000	2,940,000
Cheese	500,000	1,400,000

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

FIELD CROPS.

Varieties of Wheat (*Journ. Dept. of Agric. and Tech. Instr. for Ireland, April,* 1912).—In two series of experiments carried out at several centres, the cropping powers of White Stand-Up, White Queen, Red Chaff White, and Red Fife, were compared. At practically all the centres White Stand-Up gave the heaviest yield of grain and the greatest weight of straw, while Red Fife was the poorest in both respects. On the whole, Red Chaff White gave heavier yields than White Queen, though at some centres the latter proved superior. The average yields of grain per statute acre at seven centres were White Stand-Up 31 cwt., Red Chaff White 27 cwt., White Queen 25¼ cwt., and Red Fife 19¾ cwt. The value per quarter was distinctly higher in the case of Red Fife than in any of the other varieties.

At the Albert Agricultural College at Glasnevin in the same season several French wheats were tested along with Red Fife and the two new wheats Little Joss and Burgoyne's Fife. A few of the results were as follows: Sensation 38½ cwt. of good grain per statute acre, Dreadnought 34½ cwt., Red Marvel 34½ cwt., White Marvel 30 cwt., Little Joss 32½ cwt., Burgoyne's Fife 26¾ cwt., Red Fife 20¼ cwt. The quality of grain of the French wheats was unsatisfactory; Burgoyne's Fife was quite equal in respect of quality of grain to Red Fife.

The Growing of Tobacco for Nicotine Extraction (*South-Eastern Agricultural College, Wye,* Mr. G. H. Garrad and Mr. D. R. Edwardes-Ker).—In a previous report (see *Journ.*, August, 1911, p. 378) an account was given of the experiments in tobacco-growing carried out at Wye in the summer of 1910. The results were so encouraging that further trials of the crop were made in 1911 to test the possibility of profitably growing it and to find the variety and system of culture most likely to give the maximum yield of nicotine.

---

[*] A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

At present the price of nicotine as commonly prepared is so great that the fruit or hop grower cannot afford to take advantage of its exceptional value as an insecticide, but the results of the 1910 experiment suggested that by growing heavy yielding rank varieties and avoiding the cost of curing, a fruit-grower could grow for himself a much cheaper tobacco or nicotine, and one just as well suited for his purpose as any he could purchase.

The treatment of the different varieties under trial varied somewhat, but, generally speaking, the seed was sown in hot or cold frames about the end of March, and the seedlings were planted out about the end of May. The land used was in good condition; artificial manures were given, and the plants were placed 25 inches apart both ways. The weather at the time transplanting was going on was very hot and dry, and watering by hand had to be resorted to.

Disbudding ("Suckering") began in July, and was repeated at intervals of a fortnight. Harvesting was carried out at the end of August in the case of the *Nicotiana rustica* varieties, and at the end of September in the case of *Nicotiana Tabacum* varieties.

The chief points tested, together with the conclusions arrived at, may be summarised as follows:—

The Effect of Soil and Manure.—Tobacco grown on rich hop garden soil contained a considerably higher percentage of nicotine than the same variety grown on other types of soil. The plot receiving farmyard manure along with artificials produced the greatest weight of tobacco which contained the greatest percentage of nicotine.

Distance Apart.—It was found that, as in 1910, the closer the plants the heavier the weight of crop per acre. This advantage was, however, diminished—though not entirely counterbalanced—by the lower nicotine content of the plants closely grown.

Topping.—The 1910 experiments showed conclusively that in order to obtain a high yield of nicotine it was necessary to top the plants and indicated that it was advisable to remove all but the bottom eight or ten leaves. In 1911 topping was done at different heights, and it was found that not only did the plants which were allowed the largest number of leaves produce the heaviest crop, but that they also gave the highest percentage of nicotine—a result which may perhaps be regarded as exceptional.

Time of Cutting.—The nicotine content was found to increase when the crop was allowed to stand till mature, but when left too long a slight loss took place.

Varieties.—The most suitable variety for nicotine production appeared to be some form of *Nicotiana rustica.*

Method of Harvesting and Drying.—Artificial drying on a hop oast did not give better results than drying by hanging up in a shed for some weeks, after which only a short heating was necessary.

Cost and Returns.—The total cost of growing tobacco in 1911 was found to be at the rate of £27 an acre. On twenty-three different plots a yield at the rate of 150 lb. of nicotine per acre was obtained, giving a cost per lb. of nicotine of 3*s.* 7*d.*; some of the plots yielded at the rate of nearly 200 lb. of nicotine per acre.

On the whole the yield of nicotine in 1911 was about two and a half times as great as that obtained in 1910, a result ascribed very largely to the exceptional nature of the season of 1911. It is concluded that a yield of from 70 to 150 lb. of nicotine per acre, according to the season, may be expected, the cost of growing being from £25 to £30, *i.e.*, 3*s.* to 8*s.* 6*d.* per lb. if the crop could be grown free of duty, as compared with the market price of 15*s.* a lb.

The Extraction of Nicotine from Tobacco.—Nicotine is extracted from tobacco leaves by treatment with water, and it was found that three successive extractions with water (preferably warm) removed 97 per cent. of the total nicotine present. The solution so made, after dilution, can be used as a spraying agent. Under the Finance Act of 1912, tobacco may be grown for insecticidal purposes under Regulations prescribed by the Board of Customs and Excise. These Regulations have not yet been issued. Experiments were conducted to discover a suitable denaturant, and up to the present, spraying with copper sulphate before cutting appears to be the most hopeful of the methods tried.

Investigations on Sugar Beets (*Bull. Bur. Agric. Int. and Plant Diseases*, April, 1912). The results obtained by a large number of experimenters on various points connected with the cultivation of sugar beet are reviewed in this bulletin, and the following conclusions are drawn :—

(1) It seems to be an established fact that insufficient light causes a development of the leaves at the expense of that of the roots, with a detrimental effect on the accumulation of sugar.

(2) Whilst it cannot be denied that sugar as saccharose is formed in the organs of assimilation of the beet, it is not equally certain that it circulates as such in its passage to the organs of reserve.

(3) There is no doubt that beets in the second year of growth can produce and store sugar.

(4) There is no general law of correlation according to which the sugar content diminishes with the increase in weight of the roots.

(5) The injurious effect of size of roots on sugar content can be eliminated by selection.

Changes in the Composition of the Oat Plant as it approaches Maturity (*South Carolina Agric. Expt. Sta., Bull.* 163).—In order to ascertain at what stage oats should be cut to give the best results for different purposes, sample plots were taken daily from a uniform field, beginning at the time when the plants were just coming into bloom and continuing up to the stage when the grain became hard. Each day the crop obtained was separated by hand and the seeds, glumes, leaves and straw weighed and analysed. It was found that from the time that the first bloom appeared until the hardening of the seed, the "seed" increased from 17 to 39 per cent. of the whole crop. In the same period the proportion of leaves decreased from 47 to 28 per cent. of the whole crop. The percentage of straw reached its maximum when the oat was in the "milk" stage.

It is concluded that if the crop is to be used for forage purposes, it should be cut not later than the beginning of the "dough" stage of the seed. After this time there is a continued increase in starch in the seed, but the other parts are rapidly decreasing in value. If a nitrogenous forage is desired, the crop should be cut when the seed is in the "early milk" stage.

MANURES.

Manuring of Potatoes (*Journ. Dept. of Agric. and Techn. Instr. for Ireland, April,* 1912).—In continuation of experiments carried out in the previous ten years, tria's were conducted at nineteen centres in Ireland in 1911. The plan of the experiment, the average weights of crop obtained, and the cost of the manures in 1911 were as follow:—

Plot.	Manure per statute acre.	Cost of manures per acre.			Average total yield per acre.	
		£	s.	d.	Tons.	Cwt.
1	No manure	—			4	3
2	20 tons farmyard manure	4	0	0	9	6
3	15 „ „ „	3	0	0	8	9
4	15 „ „ „ 1 cwt. sulphate of ammonia	3	14	6	9	7
5	15 tons farmyard manure 1 cwt. sulphate of ammonia 4 „ superphosphate	4	8	6	10	3
6	15 tons farmyard manure 1 cwt. sulphate of ammonia 4 „ superphosphate 1 „ muriate of potash	4	19	0	10	18
7	15 tons farmyard manure 1 cwt. sulphate of ammonia 4 „ superphosphate 1 „ sulphate of potash	4	19	9	10	15

The results generally confirm those obtained in previous years, and justify the advice given in former reports that, as a general rule, and particularly where only a limited amount is available, dung should be used in moderate quantities and supplemented with suitable artificial manure. A complete mixture of artificial manure has proved most suitable for this purpose.

Another series of experiments was started in 1908 with the object of determining what quantity of each ingredient should be supplied in the complete mixture of artificial manures used to supplement a moderate dressing of farmyard manure. In 1911 these experiments were conducted at fifty-one centres in twenty-nine counties. A mixture of 1 cwt. sulphate of ammonia, 4 cwt. superphosphate, and 1 cwt. muriate of potash per acre was taken as a standard dressing. The increases produced by the additional quantities of one or other ingredient were only slightly greater than those required to repay the extra expenditure, and it is concluded that the results do not warrant any change in the above mixture, which has been recommended as a standard dressing for potatoes in previous years.

DISEASES OF LIVE STOCK.

Sheep Scab Investigations (*Board of Agriculture and Fisheries. Report of Proceedings under the Diseases of Animals Acts, &c.,* 1911). —These investigations were carried out at the Board's Laboratory to determine for how long acari (scab mites) and their eggs, after removal from affected sheep, retain their ability to infect other sheep;

and for how long they may remain in a quiescent state upon sheep and subsequently give rise to scab. Information on the following two points was also sought: (1) as to the period of time after what may be called ineffective dipping one may expect the active symptoms of scab to reappear; and (2) as to whether there is anything in connection with the habits of the parasite or the general condition of sheep which can account satisfactorily for the almost complete disappearance of scab, at least in a visible form, during the summer months.

Full information as to the plan and details of the investigation is given, and the following general conclusions are drawn:—

(1) That the adult forms of the acarus are the most resisting and persisting.

(2) That infection is not kept up on the pastures for a long period of time, provided the sheep are effectually dipped; and that the risk of re-infection from a sheep-walk which is not disinfectable could be rendered practically negligible by submitting the sheep to three dippings within a month with an interval of about eight days between the first two dippings.

(3) That it is inadvisable to delay the second dipping for a much longer period than eight days, as some adult acari may remain alive after the first dipping.

(4) That, although a single dipping may often cure a case of scab, it cannot be relied upon in practice to eradicate the disease from a flock; therefore compulsory dipping, when it is applied, should mean at least two dippings separated by a short interval (about eight days).

(5) That, where a very large number of sheep have to be dipped, and it is impossible to put them all through the bath in one day, and to keep the dipped securely isolated from the undipped, there is no great risk in allowing the two to come in contact provided, (*a*) all the sheep are dipped within a few days of each other, and (*b*) a second dipping of all the sheep is carried out within eight days of the first.

(6) In dipping operations special attention should be paid to the heads, necks, and tails of the sheep.

With regard to the best time for dipping from the point of view of eradication, and prevention of dissemination, everything considered, dipping in the summer months or just before the autumn sales seems to promise the best results.

Johne's Disease in Sheep (*Board of Agriculture and Fisheries. Report of Proceedings under the Diseases of Animals Acts*, 1911).—Johne's disease is generally considered peculiar to cattle, but in this Report a case is cited in which it was found in sheep brought from a farm upon which a disease known locally as "scrapie" had existed for several years. It is stated, however, that the conclusion is not warranted that "scrapie" is a form of Johne's disease.

Redwater in Cattle (*Board of Agriculture and Fisheries. Report of Proceedings under the Diseases of Animals Acts*, 1911).—An account is given of the discovery of a new species of piroplasm causing redwater in British cattle. The name *piroplasma divergens* is suggested for the species. Inoculation with the piroplasm caused an increase in temperature of animals, after an incubative period of from four to eight days, to 103–106° F., and this rise of temperature was followed by the usual symptoms which are found in connection with the disease popularly called redwater. The persistency of infectivity in the blood of a recovered animal was also characteristic of redwater.

A certain amount of evidence was also obtained showing: (*a*) that infection with the new species does not protect an animal against *piroplasma bigeminum,* and (*b*) that trypanblue, a drug which has a destructive effect on the *piroplasma bigeminum,* seems to have no serious action on the *piroplasma divergens.*

INSECT AND FUNGUS PESTS.

Tobacco Extracts and Nicotine as Insecticides (*Jour. Econ. Entom.,* June, 1912).—Experiments were carried out to test the efficacy of a solution of pure nicotine as compared with tobacco extracts of various strengths. The pure nicotine used was a 10 per cent. solution, and the extracts were of strengths containing 8 per cent., 25 per cent., 30 per cent., and 40 per cent. of pure nicotine, and in addition a 7 per cent. solution of nicotine sulphate made from pure nicotine was tried. Four different dilutions were made of all the solutions, the dilutions containing respectively 0·50, 0·75, 1, and 2 per cent. of pure nicotine. Insects (*Cimex lectularius*) were immersed in the solutions for one minute, and then taken out and examined after five days. It was shown that the effects of the treatment were not due to drowning, since insects immersed in water for one minute were unharmed.

Practically the whole of the insects were killed by the 2 per cent. dilution of each solution tested, the number killed in each case decreasing with the decreasing strength of the dilution. Pure nicotine appeared to be quite as efficacious as the four tobacco extract preparations, and to be superior to the nicotine sulphate solution. Of the extracts the 40 per cent. solution (the strongest) was the most effective.

Pure nicotine has several advantages over tobacco extract preparations in that it is cleaner to handle, less distasteful to use, and will not stain. Delicate flowers may be sprayed with such a preparation with no discoloration of the petals.

Finger-and-toe in Swedes (*Northumberland Co. Agric. Expt. Sta., Cockle Park, Guide to Experiments,* 1912).—In 1903 the swede crop on one of the fields was practically destroyed by finger-and-toe disease. Since that time swedes have been grown year after year on twenty drills of this infected field to test the effect of various dressings. The materials mentioned in the table were all put on in February, 1904, and ploughed in four inches deep; immediately afterwards the ground was thoroughly harrowed so as to distribute the dressings uniformly in the surface soil. Since 1904 no special treatment has been given, but the plots receive a moderate dressing of both farmyard and artificial manure annually.

The dressings used and the percentage of sound roots obtained on some of the plots are given on the next page.

The lime mud is a bye-product containing about 58 per cent. of carbonate of lime produced locally at alkali works.

The results show that lime has been effective in checking the disease, though it appears to have only begun to exert its action in the third year after application, doubtless owing to the time required for thorough mixing with the soil.

Plot.	Dressing per acre, 1904	Cost per acre, 1904	Percentage of Sound Roots.							
			1904.	1905.	1906.	1907.	1908	1909.	1910.	1911.
1	2½ tons lime . .	31/3	0	1	10	48	15·1	5·5	4·2	38·9
2	5 tons lime .	62/6	0	4	7	52	14·6	87·1	10·6	34·2
3	10 tons lime ...	125/	0	0	7	61	68·5	89·7	48·5	28·4
4	4 tons gas lime	10/-	0	0	0	29	6·4	10·1	2·8	11·7
5	10 tons lime mud	35/-	0	1	7	64	51·3	71·9	19·0	22·4
6	No dressing	—	0	0	0	0	3·1	0	0	0·5

In 1907 two other plots, which up to that year had produced no sound roots, were utilised to test the effects of ground lime and ground limestone. These substances were applied in May, 1907, at the time the swedes were sown, at the rate of 2 tons and 3 tons per acre respectively. They gave practically no result in 1907, but were effective in 1908, and still more so in 1909.

"Bruise in Potatoes" (*Journ Roy. Hort. Soc.*, July, 1912, Mr. A. S. Horne, Wisley Laboratory).—During the last few years a large number of cases of potatoes affected with a black discoloration of the flesh have been brought under notice. The blackening is evident immediately the potato is cut open, and is not to be confused with the discoloration which often appears after the cut surface of a tuber has been exposed to the air, nor with that which occurs in some cases after cooking, particularly at the "heel" end of the tuber. The greyish black areas characteristic of the disease occur chiefly in the outer parts of the flesh of the tuber, and the appearance is very similar to that produced by a bruise, hence the name common in some parts of the country.

With a view to ascertaining whether the disease would occur in the produce obtained from planting affected tubers, small experiments were arranged in 1908. In every case the blackened tubers, which were obtained from different parts of the country, produced perfectly healthy and normal crops. Attempts to make the disease spread from one tuber to another also failed. It was observed that the earliest stage of the disease involved the death of the storage cell of the tuber, but no fungi or bacteria could be found in the diseased cells or in the air spaces. It is suggested that "bruise" is fundamentally a physiological disease, and that it should be possible to prevent its recurrence by altering or improving the conditions of cultivation.

POULTRY.

Egg-Production (*Maryland Agric. Expt. Station, Bulletin* 157).—The effect of retaining fowls for egg-production after they have passed their second year is dealt with as one of the causes which account for a low average yield of eggs in this State. A flock of 60 pullets selected from a larger flock of 240 White Leghorns was used for the experiment. During the pullet year the 60 birds produced 10,280 eggs, or an average of 171·3 eggs per bird.

In the second year the same flock produced 8,943 eggs, or 149·05 eggs per bird.

In the third year the number of eggs produced was 6,907, or 115·1 eggs per bird.

Thus, while the decrease in the number of eggs per bird for the second year as compared with the first year was 22, the decrease in the third year as compared with the first year was 56·2 eggs per bird. This represents a considerable loss to the farmer, and one object of the experiment was to bring this loss to his notice.

The difference in production between the first and second year was much less marked, and was not sufficient to justify the discarding of second-year birds, especially as such stock is well suited for breeding purposes.

A detailed record is given of the eggs laid by each individual bird during the three years, as ascertained by the use of trap nests, and this record afforded information as to the month in which the first egg was laid by both good and poor producers during the pullet year. Of five birds which produced 200 eggs or over, all (100 per cent.) laid the first egg in November; of 56 birds producing 150–200 eggs, 55·4 per cent. laid the first egg in November, 30·4 per cent. laid the first egg in December, and 14·2 per cent. laid the first egg in January; of 109 birds producing from 100–150 eggs, 23·9 laid the first egg in November, 48·6 per cent. in December, 23·9 per cent. in January, and 3·6 per cent. in February; and of 54 birds producing less than 100 eggs, 3·7 per cent. laid the first egg in November, 31·5 per cent. in December, 44·4 per cent. in January, 13 per cent. in February, and 7·4 per cent. in March. It is suggested that these figures afford a guide to the farmer in Maryland in selecting his stock, for by picking out the birds which begin to lay in November and December, he is likely to secure a high percentage of good producers.

A system of marking poultry, either by means of leg-bands or by punching the web of the foot in newly-hatched chickens, is strongly recommended in order that the age of birds may be accurately known and that the farmer may be able to eliminate his old fowls systematically.

An account is also given of experiments conducted with regard to the time required for eggs to become fertile after a male has been added to the breeding pen, the persistence of fertility after the male has been removed from the breeding pen, and the effect of feeding maize on the colour of the yolk of eggs.

Poultry Fattening (*U.S. Department of Agriculture, Bureau of Animal Industry, Bulletin* 140).—Observations regarding the methods employed by two companies working large poultry-fattening plants in the Middle West, including a comparison of the results obtained at different feeding stations, the success attending different methods, and the comparative feeding value of different rations are discussed in this Bulletin.

The observations and experiments had reference almost entirely to trough feeding.

The total cost of food per pound of gain averaged in an experiment where 43,944 birds were fattened for from 6 to 10 days, 6·45 cents, and in a second experiment in which 61,706 birds were fed from 6 to 15 days the cost averaged 7·74 cents. The average total cost of food and labour per pound of gain for all the birds in both experiments was 9·09 cents, the average cost of food alone 7·10 cents. The cheaper gains were made in shorter feeding periods (7 or 8 days) and by light chickens.

The Improvement of the Farm Egg (*U.S. Department of Agriculture, Bureau of Animal Industry, Bulletin* 141.)—In this Bulletin the conditions which prevailed in the egg trade in the State of Kansas are considered, and an account is given of the causes which influence quality in eggs; special reference is made to the loss which arose owing to the system of buying eggs by number without having regard to quality and to the lack of care in handling the product by the farmer and merchant.

The methods adopted for improvement consisted in the organisation of buyers who agreed to adopt a system of testing eggs at the time of purchase, in a comprehensive study of the conditions in the field and in the effort to educate the Kansas farmers.

Autumn and Spring Chicken Rearing (*Harper Adams Agricultural College, Report on Field Experiments,* 1911).—An experiment was carried out to determine the cost of rearing *autumn hatched chickens* to a killing age, to note the rate of increase in weight week by week for food consumed, and to compare the cost of autumn and spring rearing.

A lot of 16 chickens was selected for the autumn rearing experiment in 1910. For the first 12 weeks they were fed entirely on dry food; from that time until the end of the eighteenth week, when they were sold, they received soft food during the day and whole barley for the evening feed.

At the end of the eighteenth week the average weight per chicken was 3 lb. 12¾ oz., the food consumed per chicken 14 lb. 9 oz., the average cost per chicken, including expense of hatching, 2*s.* 0·15*d.*, and the market value per chicken 3*s.*

In the case of the spring rearing experiment the exceptionally hot weather which prevailed in the spring of 1911 was unfavourable to growth, and the results are not regarded as conclusive.

Tests were also carried out to demonstrate how the number of fertile eggs is affected by the conditions under which the stock birds are kept. These tests suggested, among other conclusions, that the percentage of dead chickens in the shell does not bear any relation to the proportion of unfertile eggs.

Poultry Houses and Fattening Chickens (*Ontario Department of Agriculture, Bulletin* 189).—This Bulletin contains general information regarding poultry-keeping on the farm. The result of experiments conducted in order to ascertain the most suitable type of house for use on farms in Ontario pointed to the fact that the low, open-front house kept the stock in better health and required less labour than any other type.

The result of certain experiments in the fattening of chickens by trough feeding are recorded, and show that the average profit in three weeks' feeding was from 13 to 15 cents per bird.

Tuberculosis of Fowls (*Ontario Department of Agriculture, Bulletin* 193).—The spread of avian tuberculosis in Ontario, where it has been found that the poultry industry has suffered seriously in consequence, led to the issue of this Bulletin in order that information concerning the disease and suggestions for its control might be made available.

The nature of avian tuberculosis and the means by which it may be transmitted from outside sources are indicated, and the view is expressed that it is "intertransmissible between the human or bovine and the avian species to a certain extent," that "the avian bacillus, so-called, must be considered as not a distinct species, but merely a variety, the differences in character of this organism from the bovine or the human type being due to environment."

The spread of the disease in the flock through the droppings of affected birds was confirmed by miscroscopic examination, which revealed bacilli as present in the droppings in twenty-nine cases, in which the intestines were proved by subsequent post-mortem examination to be tubercular. Reference is made to the difficulty of detecting the disease in its early stages owing to the fact that the birds exhibit no definite symptoms; emaciation is usually the first symptom to be noticed.

MISCELLANEOUS.

Metabolic Water: Its Production and Rôle in Vital Phenomena (*Univ. of Wisconsin Agric. Expt. Stn., Research Bull. 22*).—Water is essential to life, and constitutes from about 40 to nearly 100 per cent. of the total weight of living organisms. Some of this is imbibed directly, some is taken with the solid food, which is rarely dry, and some of it is formed within the organism by metabolic changes in the organic constituents of the food and tissues induced by respiration and other vital processes. As a general rule plants and most animals require an abundant and regular supply of water from external sources, but in certain cases in both plants and animals metabolic water is sufficient for all purposes for considerable periods of time. Thus in the case of seeds and spores and of hibernating animals that receive no water from external sources for several months, water for all vital processes is supplied by the slow oxidation that takes place as a result of direct respiration. In addition, many varieties of insects, such as clothes moths, grain weevils, wood borers, &c., are capable of subsisting during all stages of development upon air-dried food materials containing less than ten per cent. of water.

The extensive investigations described show that metabolic water is not only produced in considerable quantities from the organic constituents of the food and tissues of plants and animals by oxidation and dehydrating reactions, but also that water so produced performs a function different to that of imbibed water, and, in many instances, if not in all, is essential to the growth and continued life of the organism. Of the conclusions arrived at, the following may be mentioned: (1) Direct respiration is essential to the continued life and to the germination of a seed. For this reason seeds intended for sowing should be stored under conditions which allow of a rather free circulation of air. (2) The final ripening changes in most fruits proceed quite as rapidly after removal from the tree as when left undisturbed. The increase in succulence during ripening is partly due to the production of metabolic water through respiration, and partly to the increased solubility of the products formed. It is not due to water derived from the tree. (3) Fruits do not ripen normally when oxygen is excluded. (4) Animals that excrete urea require a liberal supply of water to keep the urea content of the blood below a poisoning concentration. The water requirements of these animals depend largely upon the amount of protein consumed. On a protein-free diet the metabolic water, together with the free water contained in the food, is sufficient to maintain all vital processes, to remove poisonous excretions and to replace water lost in evaporation and respiration, as is shown by hibernating animals which subsist chiefly upon body fat. (5) Many varieties of insects and other animals, which excrete the waste products of protein metabolism as salts of uric acid, require no free water at any time except the small amount present in air-dried food. This is possible, because the insoluble nature of uric acid renders it but slightly poisonous, and permits of its excretion with a minimum loss of water. (6) Metabolic water derived from the oxidation of organic nutrients would probably be sufficient for all animals' needs were it not for the necessity of eliminating poisonous substances resulting from protein degeneration.

Food of Starlings and Larks (*Journ. Agric. Sci., June,* 1912; *Mr. J. Hammond, School of Agriculture, Cambridge*).—The stomach contents of a large number of starlings and larks shot in Norfolk, Essex, and Cambridgeshire were examined, with a view to discovering whether or not these birds are harmful to agriculture. The observations were continued throughout the whole year, and the birds were obtained from different localities, and while feeding on different kinds of land, but no attempt was made to investigate the effect of starlings on fruit growing.

The conclusions arrived at with regard to the starling were as follows:—

(1) The starling is very beneficial during the late spring, summer, or early autumn months, eating many harmful insects, although a number of beneficial ones are also destroyed.

(2) During the autumn, and to a less extent in the spring, much harm is done by the consumption of seed corn (particularly wheat); many harmful insects, however, are also destroyed during this period.

(3) Owing to the fact of the birds' autumn and spring migrations, the remedies suggested are: either (1) to dress the seed corn with something which renders it distasteful to birds, or (2), if suggestion (1) cannot be carried out successfully, to kill off the autumn migrants in large numbers.

In the case of the lark, it was found that the bulk of the food consisted of weed seeds; this was eked out in the summer months by insects and in the winter by pieces of leaf, for the most part of crops. It is concluded that on the whole the lark is beneficial, but, owing to the injuries done at certain times of the year there is no reason why it should be specially protected, although its wholesale slaughter is to be deprecated.

The records of a few other birds are also given, but the numbers obtained were insufficient to justify an expression of opinion as to their utility.

OFFICIAL NOTICES AND CIRCULARS.

Foot and Mouth Disease.

Four fresh centres of Foot and Mouth Disease have been discovered in Great Britain since August 9th, when the article on this subject in last month's *Journal* was written. The existence of the disease was confirmed at (*a*) Hurst Green, East Sussex, on August 16th, and at Salehurst, East Sussex, on August 19th; (*b*) Wheelton, Chorley, Lancashire, on September 1st, and at Grimsargh, Preston, on September 6th; (*c*) Hawley, near Camberley, Hampshire, on September 1st; and (*d*) Greenfield Holywell, Flintshire, on September 4th. The usual restrictions were imposed in each case prohibiting the movements of animals in a wide area.

In only two of the areas already scheduled have further outbreaks of the disease been discovered, namely, at Ryal and Little Bavington, in the Northumberland area, and at Betley, Staffs, in the Cheshire (Nantwich) area. The disease has apparently been successfully eradicated from all the other areas, and it has therefore been possible to modify the general restrictions imposed in each case, and in the case of the Cumberland, Lancashire (Liverpool and Salford), Yorkshire (West Riding), and Yorkshire (East Riding) areas, to withdraw them entirely.

Thirteen separate centres of disease have now come to light in Great Britain since the outbreak in Cumberland on June 24th last, and the total number of outbreaks confirmed up to September 9th is 75, distributed as follows :--

County.	No. of Outbreaks.
Chester	7
Cumberland	3
Durham	1
Flint	1
Hampshire	1
Lancashire	8
Leicester	3
Northumberland	28
Salop	1
Somerset	2
Staffs	1
Surrey	1
Sussex (East)	4
Yorkshire (East Riding)	2
,, (West Riding)	12
	75

Misuse of the term "Cattle Plague."

The Board of Agriculture and Fisheries desire to call attention to the fact that the employment, from time to time, in the newspaper Press and elsewhere, of the phrase "Cattle Plague" in connection with the recent outbreaks of foot-and-mouth disease in this country has given rise to considerable apprehension in Continental countries, and is calculated to be prejudicial to the interests of British stockowners. The Board wish, therefore, specifically to state that no case of cattle plague (Peste bovine, Rinderpest) has recently occurred in the United Kingdom, which has been absolutely free from that disease since the year 1877—that is, for more than thirty-five years past.

Departmental Committee on the Employment of Veterinary Officers.

The Right Hon. Walter Runciman, M.P., President of the Board of Agriculture and Fisheries, has appointed a Departmental Committee to inquire into the requirements of the public services with regard to the employment of officers possessing veterinary qualifications, and to consider whether any further measures can with advantage be adopted for the selection and training of students with a view to such employment.

The Committee will be constituted as follows: Sir Alfred Hopkinson, K.C. (Chairman), Sir Thomas H. Elliott, K.C.B., Sir Thomas W. Holderness, K.C.S.I., Mr. H. J. Read, C.M.G., and Major G. F. MacMunn, D.S.O.

Mr. H. L. French, of the Board of Agriculture and Fisheries, will act as Secretary.

Grants for Agricultural Instruction.

The Board have addressed the following circular letter, dated August 20th, 1912, to County Education Authorities in England and Wales, with reference to grants for instruction in agriculture in technical schools:—

Sir,—I am directed by the Board of Agriculture and Fisheries to inform you that, in accordance with arrangements which they have recently made with the Board of Education, the grants in respect of instruction in agricultural subjects which have up to the present been made by that Board under the Regulations for Technical Schools, &c., will, as from the 1st August, 1912, be made by the Board of Agriculture and Fisheries.

In order to avoid any inconvenience to Local Education Authorities arising from the short notice which it is possible to give of this change, the Board propose to pay grants for the ensuing year under the conditions set out in the Board of Education Regulations for Technical Schools, &c., in so far as they are applicable to technical instruction in agriculture. Local Education Authorities will therefore receive from the Board of Agriculture and Fisheries grants of the same amount and for the same purposes as they would have received from the Board of Education. The grants which are transferred will be those in respect of all technical instruction in agricultural subjects begun after the 31st July, 1912, and also grants in respect of any instruction begun after that date by any teacher recognised by the Board of Agriculture and Fisheries as a member of the staff of an Agricultural College or of a County Agricultural staff. The Board of Education will still be responsible for aiding all special courses of teachers in schools and classes receiving aid from the Board of Education. Grants in respect of gardening, although regarded as a technical agricultural subject, will be given by that Board in so far as the instruction is given by teachers who are not members of the staff of an Agricultural College or of a County Agricultural staff.

It will be seen from the Circular No. 795, issued by the Board of Education on the 6th June last, that Article 34 of the Regulations for Technical Schools, &c., has been withdrawn. The payments previously made in respect of technical instruction in agriculture under that Article will, however, be continued by the Board of Agriculture and

Fisheries on substantially similar lines for the year ending 31st July 1913.

The Board anticipate that it will be possible at a later date to simplify the procedure by amalgamating the grants made under the present Regulations with the grants which are to be made from the Development Fund for the purpose of aiding Local Authorities to extend and develop the system of Agricultural Education in their districts.

I am, &c.,
T. H. ELLIOTT,
Secretary.

Notice as to Ensilage.

In view of the unsettled character of the weather and of the consequent difficulty in securing the hay crop in some districts in which the crop is late, the Board of Agriculture and Fisheries, on August 14th, issued a notice inviting the attention of farmers to Leaflet No. 9, which describes the process of making ensilage.

Copies of the leaflet may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W. Letters of application so addressed need not be stamped.

Imports and Exports of Agricultural Produce.

Part IV. of the Agricultural Statistics for 1911 [Cd. 6385, price 5½*d*., Wyman and Sons] has been recently issued by the Board, and deals with imports and exports of corn, live stock, and other agricultural produce, and trade in live stock with Ireland. The information given in this part of the agricultural statistics was formerly included with the statistics of prices in Part III., the annual volume of agricultural statistics being now issued in five parts instead of four.

Research Scholarships in Agricultural Science.

The Board of Agriculture and Fisheries have awarded Research Scholarships in Agricultural Science to the following gentlemen, viz. :—A. W. Ashby, Univ. Dip. Economics and Political Science (Oxford), (Economics of Agriculture); W. Buddin, B.A., Univ. Dip. Agric. (Cambridge), (Plant Nutrition and Soil Problems); A. E. Cameron, M.A., B.Sc. (Aberdeen), (Agricultural Zoology); F. Cook, B.Sc., M.B., B.S. (London), (Animal Nutrition); A. Cunningham, B.Sc., Agric. (Edinburgh), (Bacteriology); J. Davidson, M.Sc. (Liverpool), (Agricultural Zoology); F. C. Minett, M.R.C.V.S. (London), (Animal Pathology); P. A. Murphy, A.R.C.Sc. (Dublin), (Plant Pathology); M. S. Pease, B.A., Univ. Dip. Agric. (Cambridge), (Genetics); W. W. P. Pittom, B.A., Univ. Dip. Agric. (Cambridge), (Animal Nutrition); J. A. Prescott, B.Sc. (Manchester), (Plant Nutrition and Soil Problems); F. Summers, B.Sc. (London), M.Sc. (Liverpool), (Plant Physiology).

The scholarships, which are of the annual value of £150 and are tenable for three years, have been established in connection with the scheme for the promotion of scientific research in agriculture, for the purposes of which the Treasury have sanctioned a grant to the Board from the Development Fund, and they are designed to provide for the training of promising students under suitable supervision with a view to enable them to contribute to the development of agricultural science.

MISCELLANEOUS NOTES.

Laying Competition of the Utility Poultry Club.

A twelve months' laying competition, beginning on October 15th next, will be carried out at the Harper Adams Agricultural College, Newport, Salop, under the direction of the Utility Poultry Club.

Birds of the following breeds will take part in the competition: White Wyandottes, 31 pens; White Leghorns, 18 pens; Buff Orpingtons, 13 pens; Rhode Island Reds and Buff Plymouth Rocks, 7 pens each; Anconas, 6 pens; Black Leghorns and La Bresse, 3 pens each; Croad Langshans, Sussex and Salmon Faverolles, 2 pens each; and White Orpingtons, Black Wyandottes, Silver-laced Wyandottes, Minorcas, Barred Rocks, and Silver Campines, 1 pen each.

The Development Commissioners have made a grant, through the Board of Agriculture and Fisheries, of £500 in respect of plant and equipment.

Importation Regulations.

Importation of Potatoes into Jersey.—The Board of Agriculture and Fisheries desire to inform potato growers and merchants that the States of the Island of Jersey have adopted an Act authorising the importation of potatoes from the United Kingdom, as from the 17th August, on the following conditions :— :

Each consignment must be accompanied (*a*) by a declaration by the shipper, indicating the farm where the potatoes were grown, and certifying that no case of wart disease of potatoes has occurred on such farm; and (*b*) by a certificate of the Board of Agriculture and Fisheries, the Board of Agriculture for Scotland, or the Department of Agriculture and Technical Instruction for Ireland, as the case may be, to the effect that no case of the said disease has occurred within five miles of the farm where the potatoes were grown.

Intending exporters of potatoes to Jersey should forward the declaration from the grower of the potatoes referred to above, when applying to the Board for a certificate. The declaration should state the name of the farm on which the potatoes were grown, the parish in which it is situate, and the nearest post town, in order that its exact position may be readily identified.

Importation of Sheep and Goats into Belgium.—A decree of the Belgian Ministry of Agriculture of 25th June, 1912, provides that sheep and goats coming from countries from which the importation is allowed, and not destined for immediate slaughter, will be kept in quarantine for ten days, in addition to being submitted to a veterinary inspection. The quarantine will be prolonged beyond this period where the animals are found to be, or are suspected of, suffering from a contagious disease. Besides the charge for veterinary inspection, a charge for quarantine will be made of 50 centimes per head for the first five animals in any lot imported, and 5 centimes per head for further animals in the herd. No compensation can be recovered for any loss suffered by the owner as a result of the quarantine or of any sanitary measures prescribed. (*Moniteur Belge,* July 19th, 1912.)

Transit of Animals through France.—A decree of the French Ministry of Agriculture of August 22nd, 1912, permits the transit through France of animals of which the importation is prohibited, provided such transit is not dangerous from the point of view of the spread of contagious diseases, and provided that the Government of the country which they enter after leaving France has agreed not to send them back into French territory.

Animals entering France under this Decree may be imported only through the custom houses at Dunkirk, Tourcoing, Blanc-Misseron, Jeumont, Givet, Ecouviez, Delle, Modane, Vintimille, Marseilles, Bordeaux, Havre, Boulogne, and Calais. The animals must be accompanied by the certificate[*] of origin prescribed for imported animals, and will be submitted to the same veterinary inspection on arrival as imported animals, a charge being made for the expenses of the latter.

After inspection, healthy animals will be allowed to be fed and watered; they must be despatched within 24 hours. Transit will take place in wagons sealed by the Customs authorities, and no detraining of the animals will be allowed. A charge will be made for disinfecting the quarters occupied by the animals on landing. (*Journal Officiel,* August 24th, 1912.)

Agricultural Exhibitions and Congresses Abroad.

Tenth International Congress of Agriculture.—The Board have been informed that the Tenth International Congress of Agriculture will be held at Ghent, Belgium, in June next, concurrently with the International Exhibition. The work of the Congress will be classified under the following five heads: (1) rural economy; (2) science of agriculture, special crops, and agricultural education; (3) cattle breeding; (4) agricultural engineering; and (5) forestry. The last Congress was held at Madrid in May, 1911, and reports on the proceedings appeared in this *Journal* for July, 1911, p. 317, August, 1911, p. 394, and September, 1911, p. 488.

Panama-Pacific International Exhibition.—The Board have been informed that it is proposed to hold a Panama-Pacific International Exhibition in San Francisco in 1915. The sum of £36,500 has been set aside to be used in premiums in the Live Stock Department, which will include horses, cattle, sheep, swine, and poultry. Further information may be obtained from D. O. Lively, Union Stock Yards, North Portland, Oregon, U.S.A.

International Congress of Electroculture.—The first International Congress of Electroculture will be held at Rheims from October 24th to 26th, 1912. Papers on electroculture and the application of electricity to agriculture, viticulture, horticulture, and agricultural industries will be read and discussed. Apparatus and photographs, drawings, &c., of apparatus used in experiments on the subject will be exhibited. Information as to the Congress may be obtained from the Secretariat général du 1er Congrès International d'Electroculture, 58 Boulevard Voltaire, Paris.

---

[*] This certificate is issued by the Board. It must not have been issued more than three days before the despatch of the animals. It must give the number and description of the animals, and must certify that no contagious disease affecting animals of the species in question exists or has existed in the place of origin during the preceding six weeks.

Notes on Agriculture Abroad.

Encouragement of Horse Breeding in Belgium.—The Belgian Ministry of Agriculture have provided for the award of twenty-five premiums, each of 1,500 fr. (£60), to owners of stallions which have gained either prizes at provincial shows or first prizes at certain other shows for stallions of three years old and under. (*Moniteur Belge*, June 16th, 1912.)

The Beet-sugar Industry in the Netherlands.—According to a report by H.M. Consul at Amsterdam there were 27 sugar-beet factories at work in 1911, and the area under cultivation showed an increase of 12 per cent. over 1910. In consequence of the hot summer, the crop was abundant, and reached the high figure of 1,720,000 tons, as compared with 1,442,000 tons in 1910, and is the largest quantity ever grown in the Netherlands. The raw sugar produced was 16 per cent. more than in 1910, and market prices ruled high. The demand for beetroot pulp for cattle food was also very active, and profitable prices were obtained.

The excellent financial results of the sugar works during the past year enabled the co-operative factories to pay their members—the beetroot growers and farmers—such high profits that large numbers of the latter have decided to establish more factories, probably in the course of 1912. This is a great danger for the non-co-operative factories, which have to buy their beetroot at competitive prices early in the year before the position of the market is known, whereas the co-operative works do not buy, but simply divide the profits among their members at the end of the season. The co-operative works also reduce the amount of beetroot available for the sugar factories worked on a non-co-operative system.

Beetroots have been imported from the United Kingdom and Germany, but mostly from the latter country. It is not expected, however, that this importation will be of a permanent nature. (*F.O. Reports, Annual Series*, No. 4855.)

The Italian Meat Trade.—A new and very important trade has been established between the River Plate and Italy, in the importation of live cattle and frozen meat. During 1911 the imports amounted to about 34,000 head of cattle, of which about one-third went through to Switzerland. The cattle found a ready sale at a fair price.

A considerable business was also done in frozen meat. This is gradually finding favour with the Italian public, due largely to its comparative cheapness, and the trade promises to increase. (*F.O. Reports, Annual Series*, No. 4858.)

Potatoes in Argentina.—An article in the official *Bull. de l'Agriculture et de l'Horticulture*, Vol. 1, No. 9 (Belgium), discusses the opportunities offered by Argentina as a market for potatoes. Although cultivated over vast areas, the Argentine crop is not sufficient for the needs of the country, and importation is especially necessary when the crop has suffered from heavy rains or extreme drought. Such a trade is likely to fluctuate greatly, however, and it is in the importation of potatoes for seed that the prospect of finding a permanently profitable market chiefly lies.

The necessity for maintaining by frequent transplantation the vigour of potatoes as regards flavour, power of reproduction, and resistance to disease, is said by the writer of the article to be particularly urgent in Argentina on account of the special nature of the soil, and the species has to be renewed year by year by the importation of foreign seed.

The principal centres of cultivation of potatoes are the districts of Balcarce and Mar del Plata in the south of the province of Buenos Aires and the district round Rosario in the north. The first two are much the more important, and are more suitable to seed from north-west Europe on account of their more temperate climate. On the other hand there are two potato harvests at Rosario.

The leading countries which export potatoes to the Argentine are France, Italy, Germany, England, Spain, and Holland. The variety of potato principally cultivated is the "Early Rose," which is exported chiefly from France.

The duty on potatoes imported into Argentina for consumption is about £2 per ton; potatoes for seed can be introduced free.

Potatoes packed for export to Argentina should be perfectly dry and free from any disease, as there is great danger of the potatoes fermenting and disease spreading during the voyage. Large quantities of potatoes had to be rejected in 1910 from this cause.

The article also contains information respecting shipping arrangements and the contracting with Argentine growers and merchants for the supply of consignments.

Importation of Canadian Cattle at Calais.—H.M. Consul-General at Calais (Mr. C. A. Payton, M.V.O.) reports that 283 "lean" oxen were landed at that port on 6th June by a British steamship, which left Montreal on 23rd May. Only one of the oxen died on the voyage, and the remainder, says the Consul-General, appear to have arrived in good condition. Customs duties are reported to have been levied at the rate of 8*s.* per cwt. The municipal veterinary surgeon inoculated each animal against tuberculosis.

It is further reported that buyers arrived from various parts of France, and from Belgium, Switzerland, and England.

This consignment, adds the Consul-General, is a new feature in the trade of Calais, and appears to be due to the initiative of a local firm. If the result is satisfactory it is suggested that there may be similar arrivals every six weeks, whilst shipments of horses are also in contemplation. (*Board of Trade Journal,* June 27th, 1912.)

Treatment of Seaweed for Commercial Purposes in Norway.—According to inquiries made by H.M. Minister at Christiania, seaweed is collected on the west coast of Norway, from Lofoten in the north to Mandal in the south. After collection it is dried in the sun and burnt without too much heat, so that the iodine is retained in the seaweed. This is effected by using damp seaweed as fuel, and only burning small heaps at a time; the experiment of burning the weed on grills has been tried, but without success. The price of the resultant ash is from ¾*d.* to 1⅓*d.* per kilogram (2·204 lb.), according to analysis; in the year 1911, during which 1,806 tons to the value of £9,933 were exported, the price appears to have averaged £5 10*s.* per metric ton (2,204 lb.).

The product is sold to agents at Stavanger and other ports, and is mainly exported to Great Britain; it is used also as manure in Norway. (*Board of Trade Journal,* July 25th, 1912.)

Premiums for the Construction of Farm Buildings in Italy.—A decree of 21st June authorises the Italian Ministry of Agriculture, Industry, and Commerce to expend a sum of £1,572 by way of premiums to be awarded with the object of encouraging the construction of modern improved farm houses and other farm buildings in the provinces of Aquila, Chieti, and Teramo. There will be, in addition to silver medals, nine premiums of £80 each, and twenty-one premiums of £40 each. (*Board of Trade Journal,* July 4th, 1912.)

Notes on the Weather in August.

The weather was extremely unsettled throughout the whole of the *first* week of August (July 28th to August 3rd). Rain was frequent and often heavy, the sky seldom clear, and thunderstorms occurred on at least one occasion in most districts. Warmth was everywhere "deficient" or "very deficient," and rainfall (except in Scotland E. and England E.) "heavy" or "very heavy." Bright sunshine was "very scanty" in England N.E. and "scanty" in all other districts.

During the *second* week the general condition was again very inclement. Rain fell daily in the south-east of England, and on most days over Great Britain as a whole. Temperature continued below the average, the deficit being about 4° over the southern and south-western counties of England. Rainfall was "heavy" or "very heavy" in all districts except Scotland W., and the excess above the average in most English districts was very large. "Scanty" or "very scanty" sunshine was again experienced.

The conditions were unseasonable in all parts during the *third* week, but the rain was generally far less heavy than during the preceding week. In some localities in the north-east of England more than half the days were rainless. Temperature continued below the average, the deficit amounting to about 6° in England S.E. and the Midland Counties, and to 5° in England E. and S.W. Rainfall was "heavy" in England S.W. and "light" in Scotland W., but "moderate" elsewhere. "Very scanty" sunshine was experienced in all districts.

The general condition was again extremely unsettled during the *fourth* week, but in some localities in Scotland and the north-east of England rain was less common than elsewhere. Thunderstorms occurred in many parts of England during the earlier half of the week, especially in the eastern half of the country. Temperature continued below the normal, the deficit exceeding 3° in most districts. Rainfall, except in Scotland W., was either "heavy" or "very heavy." Bright sunshine, except in Scotland N., was "very scanty."

Area under Crops and Number of Live Stock, 1912.

The preliminary statement of the Agricultural Returns for England and Wales collected in June last shows an increase in the arable area of 36,071 acres, and a decrease in the area under permanent grass of 115,432 acres. The areas of each of the four corn crops were substantially increased; wheat by 20,824 acres, or 1 per cent., barley by 32,205 acres, or 2 per cent., oats by 25,221 acres, or 1 per cent., and rye by 13,860 acres, the latter representing over a third of the previous year's total. The area under beans shows a reduction of 24,437 acres, but there was an increase under peas of 34,250 acres. Potatoes show an increase of almost 8 per cent., the total now being 463,007 acres, almost equal to the 464,208 acres returned in 1905. The largest decline in any arable crop was a drop of 51,715 acres under turnips and swedes. Other

PRELIMINARY STATEMENT for 1912, compiled from the Returns collected on the 4th June; and comparison with 1911.

CROPS.

DISTRIBUTION.		1912.	1911.	INCREASE.		DECREASE.	
		Acres.	*Acres.*	*Acres.*	*Per Cent.*	*Acres.*	*Per Cent.*
TOTAL AREA (excluding WATER)		**37,143,953**	37,143,953	—	—	—	—
TOTAL ACREAGE under all CROPS and GRASS (*a*)		**27,169,462**	27,248,823	—	—	79,361	0·3
ARABLE LAND		**11,335,291**	11,299,220	36,071	0·3	—	—
PERMANENT GRASS (*a*)	For Hay	**4,941,320**	4,830,823	110,497	2·3	—	—
	Not for Hay...	**10,892,851**	11,118,780	—	—	225,929	2·0
	TOTAL...	**15,834,171**	15,949,603	—	—	115,432	0·7
Wheat		**1,863,356**	1,842,532	20,824	1·1	—	—
Barley		**1,456,518**	1,424,313	32,205	2·3	—	—
Oats		**2,072,394**	2,047,173	25,221	1·2	—	—
Rye		**54,188**	40,328	13,860	34·4	—	—
Beans		**277,017**	301,454	—	—	24,437	8·1
Peas		**201,144**	166,894	34,250	20·5	—	—
Buckwheat		**4,990**	5,654	—	—	664	11·7
Potatoes		**463,007**	429,172	33,835	7·9	—	—
Turnips and Swedes		**1,072,857**	1,124,572	—	—	51,715	4·6
Mangolds		**485,645**	450,070	35,575	7·9	—	—
Cabbage		**61,414**	58,877	2,537	4·3	—	—
Kohl-Rabi		**20,352**	13,278	7,074	53·3	—	—
Rape		**79,375**	72,744	6,631	9·1	—	—
Vetches or Tares		**129,808**	102,736	27,072	26·4	—	—
Lucerne		**56,374**	53,123	3,251	6·1	—	—
Carrots		**11,700**	10,714	986	9·2	—	—
Onions...		**4,777**	4,030	747	18·5	—	—
Flax		**830**	446	384	86·1	—	—
Hops		**34,831**	33,056	1,775	5·4	—	—
Small Fruit		**77,979**	77,189	790	1·0	—	—
CLOVER and ROTATION GRASSES	For Hay	**1,554,768**	1,637,432	—	—	82,664	5·0
	Not for Hay...	**968,197**	971,345	—	—	3,148	0·3
	TOTAL...	**2,522,965**	2,608,777	—	—	85,812	3·3
OTHER CROPS		**110,036**	108,325	1,711	1·6	—	—
BARE FALLOW		**273,734**	323,763	—	—	50,029	15·5
ORCHARDS (*b*)		**244,831**	248,676	—	—	3,845	1·5

(*a*) Excluding Mountain and Heath Land used for grazing (3,795,041 acres in 1912).
(*b*) Any Crop or Grass grown in Orchards is also returned under its proper heading.

LIVE STOCK.

DESCRIPTION.	1912.	1911.	INCREASE.		DECREASE.	
	No.	*No.*	*No.*	*Per Cent.*	*No.*	*Per Cent.*
Horses used for Agricultural purposes (includ. Mares for Breeding)	**906,279**	936,749	—	—	30,470	*3·3*
Unbroken horses (includ. Stallions) One year and above ...	**234,918**	239,834	—	—	4,916	*2·0*
Unbroken horses (includ. Stallions) Under one year	**106,892**	107,420	—	—	528	*0·5*
Other Horses	**158,010**	136,916	21,094	*15·4*	—	—
TOTAL OF HORSES	**1,406,099**	1,420,919	—	—	14,820	*1·0*
Cows and Heifers In Milk...	**1,849,045**	1,867,394	—	—	18,349	*1·0*
Cows and Heifers In Calf, but not in Milk	**499,017**	525,486	—	—	26,469	*5·0*
Other Cattle :—Two years & above	**1,112,176**	1,128,315	—	—	16,139	*1·4*
,, ,, One year & under two	**1,239,346**	1,211,577	27,769	*2·3*	—	—
,, ,, Under one year ...	**1,142,324**	1,181,475	—	—	39,151	*3·3*
TOTAL OF CATTLE	**5,841,908**	5,914,247	—	—	72,339	*1·2*
Ewes kept for breeding	**7,147,561**	7,470,075	—	—	322,514	*4·3*
Other Sheep :—One year & above	**3,645,256**	4,155,393	—	—	510,137	*12·3*
,, ,, Under one year ...	**7,260,767**	7,705,182	—	—	444,415	*5·8*
TOTAL OF SHEEP	**18,053,584**	19,330,650	—	—	1,277,066	*6·6*
Sows kept for Breeding	**334,069**	375,583	—	—	41,514	*11·1*
Other Pigs	**2,162,289**	2,275,456	—	—	113,167	*5·0*
TOTAL OF PIGS...	**2,496,358**	2,651,039	—	—	154,681	*5·8*

fodder crops show increases, some of them considerable, such as mangolds (35,575 acres), kohl-rabi (7,074 acres), and vetches (27,072 acres). Flax again nearly doubled its area, and the total acreage is now 830 acres. Hops have increased by 1,775 acres, or more than 5 per cent. Clover and rotation grasses show a material diminution, chiefly in those reserved for hay. The permanent grass reserved for hay shows an increase of 110,497 acres, while that for grazing decreased by 225,929 acres.

The live-stock returns show decreases among all species of animals. Horses used for agricultural purposes are fewer by 30,470, but "other horses" (apart from unbroken horses), show an increase of 21,094. Separate returns under the latter head were first collected in 1911, and it is probable that some of the horses comprised within this category may previously have been returned as agricultural horses. Cattle have declined by 72,339, of which 44,818 were cows and heifers in milk or in calf. Sheep declined by over 1¼ millions, or 6·6 per cent., the greatest relative decline being among those (other than ewes) aged one year and above. Pigs declined by 154,681, or 5·8 per cent., the decrease in the case of breeding sows being 41,514, or 11·1 per cent.

Agricultural Conditions in Great Britain on September 1st.

The reports furnished by the Crop Reporters of the Board on agricultural conditions in England and Wales during August, state that the cold and wet have caused deterioration in the prospects of all the crops (with the exception of hops). The adverse effect of the stormy and unseasonable weather is shown by the corn crops being now expected to yield some 5 per cent. less in quantity, and potatoes 10 or 12 per cent. less than seemed probable at the beginning of August, apart from the loss in quality.

Harvesting operations generally began about the beginning of August in the southern half of the country; but while a small portion was secured early, most of what had been cut remained in stook at the end of the month, and a great deal, more particularly in the north, had not been cut at all. Much of the corn, both standing and in the stook, had begun to sprout, the quality was badly damaged, and crops were laid. In many districts, especially in the fen country, there had been floods, and some hay had been washed away. In quantity, barley is the best of the crops, but is probably 4 per cent. below average; wheat is 6 per cent. below, and oats are quite the worst crop. The young seeds have grown vigorously, and these will add to the difficulty of harvesting the spring corn. Peas have suffered more than beans, and are now the worst of the pulse crops.

Potato-disease has spread during the month, and the crops are everywhere seriously affected by it, so that a crop which a month ago promised to be average, is now bad. Perhaps Lincolnshire has experienced the most severe attack, but reports of fields rotting have been received from various parts of the country.

The weather has been too cold and wet for the roots, which are generally quite healthy, but have made very little growth. The prospects for mangolds are now about average, those of turnips and swedes being rather poorer. Dry weather now would, however, effect improvement.

A great deal of hay has been out and exposed to the weather during the month, and it has suffered much damage, even in the south-west. In the more northern districts the damage is proportionally greater, and much has yet to be cut.

The condition of hops is generally satisfactory, and the inclement weather of the month has only slightly reduced the prospects, which are for a nearly average crop. The wet and cold have kept down the aphis, which had previously given great trouble and necessitated constant washing. The area under hops in England is this year 34,831 acres.

Apples are yielding a fully average crop; pears are good; and plums, although deficient, are yielding rather better than was anticipated.

Pastures have been full of keep, but it has been so wet as to be generally of poor quality, and live stock have, in consequence, and also as a result of the ungenial weather, not done particularly well upon the whole. Sheep have not done so well as cattle.

Summarising the results and representing an average crop by 100, the appearance of the crops on September 1st indicated yields for England and Wales which may be represented by the following percentages:—Wheat, 94; barley, 96; oats, 87; beans, 94; peas, 92; potatoes, 89; turnips and swedes, 99; mangolds, 100; hops, 99.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for August, 1912, issued by the International Institute of Agriculture, contains official information received up to August 17th. The prospects of cereals in *Germany* have slightly improved since the date of the last *Bulletin*, and the condition of wheat and rye is now given as 2·4, spring barley as 2·2, and oats as 2·7 (1=excellent, 2=good, 3=average, 4=bad, 5=very bad). In *Austria* also wheat, rye, and barley have slightly improved, and, using the same scale, their condition is placed at 2·3, 2·2, and 2·5 respectively, while that of oats and maize, which have slightly deteriorated, is estimated at 2·2 and 1·9 respectively. In *Belgium* drought had hastened the ripening of the cereals, especially of wheat and oats. Although harvesting has been interrupted by frequent rains, the crops are being cut under good conditions. Variable weather conditions prevailed in *Bulgaria*, heavy rain and hail doing considerable damage in the north, while in the south the crops were suffering from drought. In *France* frequent rains and continued stormy weather have lodged the crops in many regions, fostered the growth of weeds, favoured the development of fungoid diseases, and hindered the harvest. On August 1st, however, the general condition of barley and oats was satisfactory. Fairly good yields of oats and rye are predicted, but the yield of wheat will probably not come up to previous expectations, although it will not in any case be below that of last year. Maize is well developed in *Hungary*, and the general condition good, but, owing to lack of moisture, it is in a few districts turning yellow. In *Italy* hot and dry weather prevailed during the whole of July, and it is feared that the cereal harvest will not come up to previous estimates. Maize is still in good condition, but is beginning to feel the effects of the drought. The condition of wheat, barley, and oats in *Norway* was good to excellent, and that of rye excellent. In *Russia*, although the ripening of the grain has been somewhat delayed by cold and damp weather, a yield above the average is expected for all the cereal crops. In *Canada* the general conditions and prospects are favourable throughout the country. In *Japan* the condition of wheat, barley, and maize is average, and that of oats bad.

Forecasts of Total Production.—In addition to the estimates given in last month's *Bulletin*, estimates of the production of the corn crops in Russia (73 Governments), Prussia, Bulgaria, Denmark, Canada, and Egypt are now given. The principal countries in the northern hemisphere, for which figures have not yet been received, are the German States other than Prussia, France, Scotland, Ireland, Norway, Netherlands, Roumania, and Sweden. The total production of wheat in those countries in the northern hemisphere for which figures are available is estimated at 343,349,000 qr., or an increase of 6·7 per cent. over the yield of 1911; that of barley at 134,617,000 qr., or an increase of 4 per cent.; that of oats at 341,139,000 qr., or an increase of 14·1 per cent.; and that of rye at 176,517,000 qr., or an increase of 18·4 per cent. In Russia the yield of all four crops will be considerably in excess of that of last year, the yield of wheat being 93,716,000 qr., an increase of 47·2 per cent.; that of barley 54,966,000 qr., an increase of 10·6 per cent.; that of oats 105,878,000 qr., an increase of 20·3 per cent.; and that of rye, 114,851,000 qr., an increase of 29·2 per cent. There is, however, a decrease of 24·8 per cent. in the yield of maize, the estimated production for 1912 being 7,221,000 qr.

Southern Hemisphere.—Winter cereals were sown under favourable conditions in Chile. The areas sown in 1912 with winter wheat and winter barley are 1,043,000 and 91,000 acres respectively. In Argentina sowing is not yet completed. In New Zealand wheat and oats, which are now all sown, were drilled under bad conditions, but fairly good conditions now prevail for the sowing of winter barley. The area sown with winter wheat is 348,000 acres, or 67 per cent. of last year's area; with winter barley 67,000 acres, or 90 per cent.; and with winter oats 988,000 acres, or about the same area as in 1911.

Sugar Beet.—The condition of sugar beet in Austria has improved since last month, and promises an excellent crop. In Belgium, Denmark, France, and Italy the prospects are also very good. In Hungary the yield is expected to be a good average.

Germany.—Consular reports, referring to the north-east of Prussia and to Wurtemberg, state that the rain during August has materially damaged the prospects of the corn crops. In Wurtemberg the first crop of hay was excellent, and was stacked in good condition. The aftermath promises well, and if that also can be stacked under favourable conditions there will be an ample supply of fodder.

Hungary.—An official report of August 19th states that the abundant rain of the last few weeks has had a beneficial influence on the maize crop, and the production is now estimated at 23,444,000 qr., compared with 16,038,000 qr. last year.

Russia.—H.M. Consul at Odessa, in a report dated August 30th, states that this year's harvest in south Russia is very late. Although the bulk of the corn was got in before bad weather set in, there is still a considerable quantity lying in the fields. Owing to rain, threshing is proceeding very slowly. In other parts of the country, especially in the north, the harvest is much better.

New South Wales.—The Preliminary Report of the New South Wales Bureau of Statistics gives the following figures relating to the acreage and production of the corn and hay crops for the season ended June, 1912:—

	ACREAGE.		PRODUCTION.	
	1911–12.	Difference in 1911–12 from 1910–11.	1911–12.	Difference in 1911–12 from 1910–11.
	Acres.	Per cent.	Bushels.	Per cent.
Wheat	2,380,733	+ 11·8	25,116,746	- 10·0
Oats...	72,325	- 7·3	1,141,849	- 32·9
Maize	168,258	- 21·0	4,480,000	- 41·0
			Tons.	
Hay...	651,924	+ 2·1	728,557	- 13 6

Potatoes: *Germany.*—The area under potatoes is slightly greater (0·6 per cent.) this year than last. On August 1st, according to an official report, the condition in Bavaria, Wurtemberg, and some other provinces was considered very satisfactory, and a good yield was promised. From other districts, however, came complaints of thinness and disease. The effect of the drought had been very unfavourable, so that the average condition for the whole country promised a yield below average. A Consular Report of July 26th stated that hot weather and drought had unfavourably affected potatoes on sandy land in N.E. Germany, and they were shrivelling up. A report of August 19th stated that disease was appearing, and dry and warm weather was required. According to a Consular Report of September 2nd, disease was prevalent in Wurtemberg, and the continued wet weather was having a disastrous effect on the crop. *Austria.*—On July 1st potatoes were, for the most part, healthy, but there were some complaints of leaf curl. The general condition promised a yield above average. *Hungary.*—An official estimate of August 19th places the production of potatoes this year at 5,378,000 tons, compared with 4,437,000 tons in 1911. *France.*—An official report of July 1st stated that in one department the condition was very good, in two good, in fifty fairly good, in twelve passable, and in three poor. *Italy.*—An official report of July 3rd stated that the condition of potatoes was generally very satisfactory, and a good yield was to be expected. *Holland.*—According to an official report of July 15th, the condition of potatoes was generally good, and in the provinces of Friesland and Groningen very good. *Norway.*—A Consular Reoprt of July 3rd stated that the potato crop promised well throughout the country. *United States.*—The production is estimated at 352,000,000 bushels, compared with 292,737,000 bushels last year. *Canada.*—The area under the crop this year is 459,400 acres, compared with 459,097 acres in 1911.

Hops.—H.M. Consul-General at San Francisco reports, on the authority of the local press, that the area under hops in Calfornia is 22,000 acres, in Oregon 22,000 acres, and in Washington 6,000 acres. The yield in California is estimated at 149,000 cwt., in Oregon at 165,000 cwt., and in Washington at 41,000 cwt., a total of 355,000 cwt. Another estimate places the total at 380,000 cwt. The Californian crop shows an increase of 8,300 cwt. compared with that of last year.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on September 1st, 1912, certain diseases of animals existed in the countries specified:—

Austria (for the period August 14th—21st).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 575 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period July 16th—31st).

Anthrax, Blackleg, Foot-and-Mouth Disease (3 "foyers" in 1 "commune"), Glanders and Farcy, Rabies.

Bulgaria (for the period July 29th—August 6th).

Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Swine Fever.

Denmark (month of July).

Anthrax, Foot-and-Mouth Disease (8 cases), Swine Erysipelas.

France (month of July).
Anthrax, Blackleg, Foot-and-Mouth Disease (2,426 "étables" in 635 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period August 1st—15th).
Foot-and-Mouth Disease (195 infected places in 55 parishes), Glanders and Farcy, Swine Fever.

Holland (month of July).
Anthrax, Foot-and-Mouth Disease (2 outbreaks in 2 provinces), Foot-rot, Swine Erysipelas.

Hungary (for the period August 1st—7th).
Anthrax, Foot-and-Mouth Disease (total of 86 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period July 29th—August 4th).
Anthrax, Blackleg, Foot-and-Mouth Disease (24 new cases entailing 742 animals), Glanders and Farcy, Sheep-scab, Swine Fever.

Montenegro (for the period June 15th—July 1st).
Glanders and Farcy.

Norway (month of July).
Anthrax, Blackleg, Swine Fever.

Rumania (for the period August 6th—13th).
Anthrax, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of April).
Anthrax, Foot-and-Mouth Disease (1,702 animals in 49 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period July 20th—27th).
Anthrax, Rabies, Sheep-pox, Swine Fever.

Spain (month of June).
Anthrax, Dourine, Foot-and-Mouth Disease (103,298 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of June).
Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (for the period August 12th—18th).
Anthrax, Blackleg, Foot-and-Mouth Disease (127 "étables" and "pâturages" entailing 8,634 animals, of which 15 "étables" and "pâturages" were declared infected during the period), Swine Fever.

Agricultural Labour in England during August.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in August:—

Owing to the exceptional amount of rain which fell during August, harvesting operations suffered serious hindrance, and labourers outside the regular farm staff were generally in irregular employment. When the weather permitted there was generally a good demand for such extra labourers, and in several districts in the Northern and Midland counties an insufficient supply was reported.

Northern Counties.—Rain caused considerable interruption to haymaking and other outdoor work in these counties. When the weather permitted, however, there was a good demand for extra labour, which was not always satisfied by the supply. A correspondent in the Doncaster (*Yorkshire*) Rural District reported a falling-off in the number of Irish migratory labourers, and some scarcity of extra men was also reported in the Easingwold (*Yorkshire*), Hexham (*Northumberland*), Penrith (*Cumberland*), and Whiston (*Lancashire*) Rural Districts.

Midland Counties.—A good deal of time was lost by extra labourers in many districts on account of wet weather. Apart from such interruption extra men were generally well employed; the demand was in excess of the supply in the Bucklow (*Cheshire*), Belper and Hayfield (*Derbyshire*), Billesdon and Melton Mowbray (*Leicestershire*), Leek and Cannock (*Staffordshire*), and Buntingford (*Hertfordshire*) Rural Districts. A surplus of such men was reported in the Buckingham and Watford (*Hertfordshire*) Rural Districts.

Eastern Counties.—In most districts in these counties the corn harvest was seriously hindered by rain, particularly in the latter part of the month. A good deal of time was in consequence lost by extra labourers, many of whom had already been engaged by farmers to perform the harvest on contract. A scarcity of Irish migratory labourers was reported by a correspondent in the Welton (*Lincolnshire*) Rural District.

Southern and South-Western Counties.—In these counties, as in most other parts of the country, rain caused a good deal of interruption to outdoor work, and extra men were generally in irregular employment. There was a good demand for extra labourers for haymaking, the corn harvest, hoeing, and hedge-trimming when the weather permitted. A surplus of such men was mentioned in the reports from the Guildford and Hambledon (*Surrey*), Droxford, Havant and Winchester (*Hampshire*), and Westbury (*Wiltshire*) Rural Districts; in the Eltham (*Kent*) some scarcity of men was reported. Some scarcity of men for permanent situations was reported in the Godstone (*Surrey*), Petworth (*Sussex*), Dursley and Stow-on-the-Wold (*Gloucestershire*), and West Penwith (*Cornwall*) Rural Districts.

THE CORN MARKETS IN AUGUST.

C. KAINS-JACKSON.

Wheat.—At the close of July a few new crop samples were already showing, and, in anticipation of liberal deliveries within a fortnight, forward purchases of foreign wheat for supply after August 15th or thereabouts were cut down to a small total. As the month wore on and the season became less and less clement, a hurried business for prompt needs had to be done, and the holders of imported wheat obtained about a shilling per quarter more money than they had been accepting a few weeks previously. On the 11th, however, the American Bureau Report had revealed a larger wheat production in the United

States than had been anticipated, and a few days later the International Institute gave a favourable account of Central European production. Before August closed a large export surplus of wheat had been assigned to Russia on official advices, and the news from Canada also pointed to a good margin for exportation. Thus the rising prices were checked, and September came in with sellers for October delivery at somewhat markedly under spot prices. The supplies of new English wheat had by the last week of August become large enough to affect the averages, which showed material decline at such important centres as Peterborough, Norwich, Ipswich, and Chelmsford. The London, Salisbury, Manchester, and Doncaster markets were less affected. The new samples are damp and soft, and seldom fit for prompt use in the mill. Natural quality is not so bad; it is the protracted and disastrous ingetting which has spoiled the crop.

The August imports were liberal, prevailing winds favouring the arrival of many sailing-ships on passage from distant countries. Thus the stock of landed wheat in granary has risen substantially on the month, and with no more than moderate shipments, the supply on passage has declined. Reserves on 1st of month, 2,020,000 qr.; on 31st, 2,620,000 qr.; on passage, 1st of month, 3,330,000 qr.; on 31st, 2,400,000 qr. August shipments were: from North America, 1,170,000 qr.; from South America, 1,206,000 qr.; from India, 969,000 qr.; from Russia, 989,000 qr.; from Europe S.E., 619,000 qr.; and from Australasia, 141,000 qr. The last-named region also shipped to South Africa quantities which, without being given in figures, are cabled as "good."

The range of English wheat prices at the close of August was from 33*s.* to 39*s.* for new crop, and from 38*s.* to 42*s.* for old. Of the latter extremely little seems to be left. Imported wheat on the 30th at Mark Lane and Liverpool, on the 31st at Newcastle, was making 42*s.* 6*d.* for fine Canadian, the best Australian, and North Russian; 41*s.* 6*d.* for South Russian where clean; 39*s.* 6*d.* for Indian White; 39*s.* for Indian Red; and 38*s.* for ordinary La Plata. The American forward market for prompt shipment quoted 36*s.* 9*d.* for No. 2 Hard Winter and 38*s.* 6*d.* for No. 1 Hard Duluth (or spring) wheat. The first of these sorts goes in price pretty much on a parity with average English when the latter is in good, dry condition. No general estimate is possible of the deduction to be made in the case of the new home crop as a result of its being kept in store by millers until dried and conditioned, but it is feared that the depreciation for some weeks ahead will seldom be less than half-a-crown per quarter.

Flour.—Imports have continued to be small, and North America has shipped less than usual. A little over two hundred thousand sacks are on passage, the North American contribution being 138,000 sacks. During the month Top-price declined from 34*s.* to 33*s.*, and Town Households from 28*s.* 6*d.* to 28*s.*, but Country flour, through scarcity, maintained its value. Imported descriptions at the end of the month contrasted in price very strikingly with a year previously, the best American making fully 30*s.* 6*d.* against 27*s.* 6*d.* a year before, while the best Hungarian had come down from 41*s.* 6*d.* to 37*s.* 6*d.* These ups and downs within a single trade are not easy to explain, but they go to make a market by rewarding the expert buyer. Owing to the chilly weather for the time of year, Liverpool and Glasgow did a rather better business in flour than usual during August, but the London demand for prompt use remained poor throughout the month.

Barley.—The persistent rains prevented any good malting samples appearing at the markets, and the best prices realised thereat, 34*s.* to 35*s.*, were obtained for dry and bold samples of winter barley reaped before the August rains. Stained barley of the new crop was selling at Salisbury towards the close of the month at the low average of 23*s.* 2*d.* Imported barley was at first hard to sell, but with nothing much forthcoming of the new home crop, by about the 19th the markets began to harden, and they closed in sellers' favour. As a rule 29*s.* to 30*s.* was commanded by Russian, 28*s.* to 28*s.* 6*d.* by Indian. August shipments were 464,000 qr. from India, 87,000 qr. from Europe S.E., and 460,000 qr. from Russia. The new crop in California was reported to be a good one, and 45,000 qr. were exported. A much more considerable trade is expected soon. Supplies of barley on passage on the 31st were rather small—365,000 qr.

Oats.—Shipments from Russia, 134,000 qr., and from Argentina, 318,000 qr., being below prospective requirements, the market during August had a hardening tendency. Canada sent off 109,000 qr., a welcome consignment for which British buyers are paying a ready 23*s.* per 320 lb. The supply on passage at the end of the month was only 200,000 qr., so that established prices for foreign seemed for some little while assured. The forward market was, however, overshadowed by Russia's anticipated surplus of over eighteen million quarters available for exportation. The home crop has been in singularly small supply, but the damage done by the August rains did not appear to be so great as in the cases of wheat and barley. Some very fair Tartary oats were on sale, and some good Gartons had also reached Mark Lane by the 30th. The total quantities immediately deliverable were, it is true, a great deal below the average. The mean price of the home crop kept above a sovereign per quarter at Mark Lane, Canterbury, and Peterborough, as well as at the principal northern markets such as Doncaster and Berwick, whereat the offerings were still "old crop."

Maize.—A million quarters are on their way from Argentina and 160,000 qr. from all other countries. This large prospective supply has exerted a very great influence, so that as August went out 26*s.* 9*d.* was paid for delivery a week therefrom, 25*s.* 9*d.* a month therefrom, and 24*s.* 9*d.* only for October delivery. The price at which Argentina is prepared to ship in October and November is as low as 24*s.* cost freight and insurance to the Thames or Mersey. A leading shipping list put the world's maize production for 1912 at 53,700,000 qr. larger than for 1911 (Beerbohm's List, August 30th). This made full allowance for reduced promise in Eastern and South-eastern Europe, but assessed the United States crop, to be reaped in October, at a high figure—320,000,000 qr. The August shipments of Indian corn were 3,509,000 qr. from Argentina, 162,000 qr. from Russia, and 123,000 qr. from Europe S.E. The August arrivals were considerable, but went quickly into consumption.

Oilseeds.—There is a decline on the month in Argentine linseed, but Indian sorts remain decidedly dear. The quality difference not being nearly enough to account for 5*s.* to 6*s.* difference in price, demand has naturally set in the direction of the La Plata product. There are now but very moderate quantities of oilseeds on passage, both linseed and cottonseed presenting under-average totals. August shipments of linseed were 270,000 qr. from South America and 176,000 qr. from India.

Various.—Beet-sugar has maintained its July recovery for prompt supply, but the new crop continues to be offered for November shipment to London at 10*s.* per cwt. There is, as may be surmised, a good deal of speculation about this market. Canary-seed has fallen to 57*s.* 6*d.*, or half-a-crown from July. Articles which were dear as August closed were rice, bran, fine middlings, haricots, barley meal, and split peas, while English buckwheat and rye, each at 31*s.* per qr. and Cyprian locust beans at 6*s.* per cwt., were attractive quotations to the buyer. A welcome supply of Persian millet at 26*s.* to 27*s.* per qr. was a useful substitute for Argentine sorghum, the supply of which for some reason or other appears of late to have given out.

THE LIVE AND DEAD MEAT TRADE IN AUGUST.

A. T. MATTHEWS.

Fat Cattle.—There was a slight but steady fall in the average price of fat cattle throughout the month. The weather has been favourable for the production of a good bite of grass as regards quantity, but the deterioration of its quality has been greater than usual, and cattle have not thriven nearly so well as earlier in the grazing season, except where large quantities of artificial food have been given. It may therefore be fairly concluded that the decline in intrinsic values has been more apparent than real, especially when it is seen that at such markets as Ipswich, where prime stall-fed cattle are always more or less in evidence, prices have been well maintained.

The following average prices in English markets for the various breeds show a general decline of barely ¼*d.* per lb. :—Shorthorns, 9*s.* 3*d.* and 8*s.* 3*d.* for first and second quality, against 9*s.* 5*d.* and 8*s.* 6*d.* in July; Herefords, 9*s.* 5*d.* and 8*s.* 8*d.*, against 9*s.* 8*d.* and 8*s.* 10*d.*; Devons, 9*s.* 3*d.* and 8*s.* 2*d.*, against 9*s.* 6*d.* and 8*s.* 6*d.*; and Polled Scots, 9*s.* 8*d.* and 9*s.* 0*d.*, against 9*s.* 8*d.* and 9*s.* 5*d.* per 14 lb. stone. Welsh Runts averaged 9*s.* and 8*s.* 3*d.*, but this breed usually improves its relative position nearer the end of the grazing season. The trade in Scotland has continued especially good, and in ten markets north of the Border, Shorthorns have averaged about 46*s.* per live cwt., against about 41*s.* in those English markets which are quoted by live weight.

Readers of the weekly reports will have noticed that Devons at Truro have been quoted at much lower prices than elsewhere, and this lowered the average for that breed. It is explained by the fact that Cornish Devons are mainly of the South Ham variety, a coarser and inferior class compared with the North Devons.

Veal Calves.—The trade in fat calves was very even from week to week, and average prices were the same as in July, again working out at 8¼*d.* and 7¼*d.* per lb., yet values ranged from 9½*d.* down to 7½*d.* for best quality at different markets.

Fat Sheep.—During the first two weeks the sheep trade generally was remarkably firm, but began to weaken in the latter half of the month. Prime Downs again averaged 8¾*d*. per lb. in about twenty English markets, second quality 8*d*., against 7¾*d*. in July, and third, 6½*d*. against 6¼*d*. The averages for Longwools were almost the same as in July, viz., 8¼*d*., 7½*d*., and 6*d*. per lb.

The term "Down" as used in all market reports applies to breeds which differ greatly in value per lb., and this explains the apparent discrepancies in value which are often seen. A difference of 1¼*d*. per lb. between markets at no great distance from each other is extremely improbable in sheep of the same quality in the same week, but this often appears to be the case. It is scarcely practicable to quote separately all the breeds that claim the title of "Down," and readers can only conjecture which of them is referred to by the locality of the markets quoted.

Fat Lambs.—Lambs have continued to be rather freely offered in about forty markets of England and Scotland, surprisingly so when the good prospects of the turnip crop are considered. The demand has been fairly good, and 10*d*. per lb. is still reached in several markets. The general average price in August was ¼*d*. per lb. lower than in July, working out at 9½*d*. and 8½*d*. per lb. Some of the heavy lambs are already being retailed to the consumers as small mutton.

Fat Pigs.—Bacon pigs have again met a ready market at slightly hardening prices. There has been no sudden advance, but values have been gradually creeping up till they are now about 1*s*. per stone higher than those of a year ago. The averages for August are 7*s*. 5*d*. per 14 lb. for first, and 6*s*. 10*d*. for second quality.

Carcass Beef—British.—Supplies of Scottish beef to the Central Market have been small in consequence of the high values of fat cattle in Scotland, and most of that arriving has come in the form of short sides. Yet prices have been lower than in July by nearly ½*d*. per lb. Short sides averaged 5*s*. 3*d*. and 4*s*. 11*d*. for first and second quality, and long sides 5*s*. and 4*s*. 9*d*. The supply of English was almost nominal excepting those of cow-beef. That quoted has been nearly all Irish, killed at Deptford, and this averaged 4*s*. 3*d*. and 4*s*. per 8 lb. stone. In the last week there was a great and sudden fall in all the cheaper classes of beef, and the Irish sold as low as 3*s*. 6*d*. to 3*s*. 8*d*. per stone.

Port-Killed Beef.—Supplies of American port-killed have been irregular and not large at any time. There has been some this month from Birkenhead, and this has averaged rather more than that from Deptford, having happened to arrive on the dearer days when none came from the latter port. The averages were for the whole 4*s*. 4*d*. and 4*s*. for first and second quality.

Chilled Beef.—This article, now such an important one in our markets, has fluctuated rather violently during August. Starting at 3*s*. 4*d*. per 8 lb. for best hindquarters, it advanced to 3*s*. 10*d*., and in the last week suddenly dropped to 3*s*., with second quality as low as 2*s*. 6*d*. This was owing to large arrivals and the competition of cheap Irish beef. Forequarters were steadier, and fetched 2*s*. 2*d*. to 2*s*. 4*d*. till the last week.

Frozen Beef.—"Hard" beef was a quiet, steady trade for the first three weeks at about 2*s*. 8*d*. per stone for hindquarters and 2*s*. 2*d*. for fores, but at the end of the month it was impossible to move it owing to the low price of chilled.

Carcass Mutton—Fresh Killed.—British and Dutch mutton have been decidedly cheaper than in July. The principal demand was for small Scotch, and as supplies of that were small, prices were relatively better than for English. Averages were:—Scotch, 5*s.* 2*d.* and 5*s*; English, 4*s.* 8*d.* and 4*s.* 6*d.*; Dutch, 4*s.* 7*d.* and 4*s.* 5*d.* per stone.

British Lamb.—Scotch lamb has been offering in quantities quite large enough for the demand, and has scarcely exceeded small mutton in value. Quotations were steady all through at 5*s.* to 5*s.* 4*d.* per stone. Very small mountain lambs were much lower in price, but these will be wanted for the end of the season.

Frozen Mutton and Lamb.—Trade has been very steady for frozen mutton, showing little change from July prices. Best New Zealand averaged 3*s.* and 2*s.* 8*d.* per stone, and Australian and Argentine 2*s.* 9*d.* and 2*s.* 6*d.* New Zealand lamb was in steady request at 3*s.* 8*d.* to 4*s.* 2*d.*, according to quality.

Veal.—The average price of prime British and Dutch veal was 5*s.* 4*d.* per 8 lb., but only a small proportion of fine quality was on offer. Large quantities were sold at 4*s.*, and even less money.

Pork.—Short supplies came forward, and with a very good demand prices steadily advanced, reaching 5*s.* 2*d.* per stone for small sizes in the last week.

THE PROVISION TRADE IN AUGUST.

HEDLEY STEVENS.

Bacon.—The very wet and unseasonable weather during the month has seriously affected the consumption of all hog products, hams having suffered more severely than any other cut. It is during August that dealers look to have a larger trade than at any other time of the year, and provide accordingly; consequently this year large stocks of some cuts (especially hams) have accumulated, and unless the demand during September shows an improvement, a good many importers will again have to face serious losses on their holdings.

The arrivals from America and Canada have been small, and are likely to continue so for some weeks to come, as at the present prices of hogs the business is not remunerative to the American and Canadian packers. The demand for hog products in the United States is large on account of the scarcity and high price of beef, and it is reported that these conditions will last for some time. The receipts of hogs in America continue to show a falling off in numbers, and the prices at Chicago during the month have fluctuated from $7.15 to $8.75, against $6.85 to $7.80 during the same period of last year, and $7.40 to $9.25 two years ago.

English pigs are still high in price, and to obtain sufficient supplies some of the West of England curers are buying in the Eastern Counties, the long railway journey adding, of course, very considerably to the cost of the raw material.

Cheese.—The outstanding feature of this trade during the month has been the abnormally high range of prices ruling in Canada, which have been as high as equal to 67*s*. 6*d*. c.i.f. English ports. This is higher than the figures at the same time last year, when most of the cheese-making countries were suffering from the effects of extremely dry weather. At these extravagant prices importers have found a great difficulty in making profits, as with the favourable weather conditions in this country and Canada, they see no reason for such high prices, and are all the time looking for a reaction, which up to the time of writing has not resulted. It is reported that the make in the United States show a decided increase over last year, and that the quality is much finer.

On account of the high prices realised in this country last year for their consignments, the New Zealand factorymen will not contract this season's outputs under several shillings' advance on the prices paid last year for the season's deliveries.

Butter.—On account of the prevailing high prices—although they are lower than at the same time last year—there has been very little life in the trade. The arrivals from Siberia have continued large, and one week during the month constituted a record, 39,201 casks being landed. Fair quantities have been cold-stored for consumption later. Irish Creameries have fallen several shillings during the month, and there has been a little more doing in secondary butter, but stocks of this description are very heavy.

There have been no arrivals from either Canada or the United States, prices in both those countries being beyond a competitive basis. On August 1st the stored stock of butter in Montreal was 103,000 packages, against 46,000 on July 1st, which is a provision for their winter demand. Last year, after exporting fair quantities to England, they ran short of stock, and early in the year some of the exported lots were repurchased in this country and returned to Canada to fill in the gap until the new season opened.

The factories in New Zealand are asking equivalent to 122*s*.–124*s*. c.i.f. for the coming season's outputs, but importers are refusing to entertain the price.

Eggs.—Prices early in the month rose in sympathy with shorter arrivals from the Continent, but the inclement weather and poor demand later in the month checked the advance.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of August, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	England.		Scotland.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Polled Scots	9 8	9 0	47 3	42 8
Herefords	9 5	8 8	—	—
Shorthorns	9 3	8 3	46 2	41 8
Devons	9 3	8 2	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	8¼	7¼	8¼	7
Sheep:—				
Downs	8¾	8	—	—
Longwools	8¼	7½	—	—
Cheviots	9¼	8	8¾	7¾
Blackfaced	8¼	8	8½	7¼
Cross-breds	8¾	8	9	8
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Bacon Pigs	7 8	7 2	6 9	5 11
Porkers	7 8	7 4	7 4	6 7
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ *s.*	£ *s.*	£ *s.*	£ *s.*
Shorthorns—In Milk ...	22 0	18 8	23 6	19 3
,, —Calvers... ...	21 7	18 8	21 14	18 2
Other Breeds—In Milk ...	20 4	16 1	21 11	17 1
,, —Calvers ...	16 5	14 0	22 0	17 13
Calves for Rearing	2 5	1 15	2 15	1 17
Store Cattle:—				
Shorthorns—Yearlings ...	10 14	8 15	11 9	9 17
,, —Two-year-olds...	14 4	12 16	17 10	14 17
,, —Three-year-olds	18 10	16 10	—	—
Polled Scots—Two-year-olds	—	—	18 9	14 16
Herefords— ,,	16 6	14 7	—	—
Devons— ,,	14 1	12 1	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Downs or Longwools ...	34 3	29 4	—	—
Scotch Cross-breds ...	—	—	26 10	22 3
Store Pigs:—				
8 to 10 weeks old	17 0	13 10	19 1.	15 10
12 to 16 weeks old	27 9	21 0	28 6	—

* Estimated carcass weight.
† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of August, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt. *s.* *d.*	per cwt. *s.* *d.*	per cwt. *s.* *d.*	per cwt. *s.* *d.*	per cwt. *s.* *d.*	per cwt. *s.* *d.*
BEEF :—							
English	1st	61 0	54 0	59 6	59 0	69 6*	69 0*
	2nd	56 6	52 0	56 6	56 0	62 6*	60 0*
Cow and Bull ...	1st	52 6	49 6	48 6	50 6	58 6	56 0
	2nd	46 0	42 6	43 6	45 0	53 0	48 0
U.S.A. and Canadian :—							
Port Killed ...	1st	60 6	57 0	59 0	—	—	—
	2nd	56 0	53 6	55 0	—	—	—
Argentine Frozen—							
Hind Quarters...	1st	36 6	38 0	37 6	38 0	37 6	39 0
Fore ,, ...	1st	30 0	29 0	29 6	29 6	30 6	31 0
Argentine Chilled—							
Hind Quarters...	1st	47 0	46 0	48 6	46 6	50 6	51 6
Fore ,, ...	1st	32 0	32 0	31 6	32 0	33 0	33 0
Australian Frozen—							
Hind Quarters...	1st	36 6	34 0	35 6	36 0	—	37 6
Fore ,, ...	1st	31 0	28 0	29 6	28 0	—	30 0
VEAL :—							
British	1st	—	68 0	75 0	64 0	—	70 0
	2nd	60 6	61 0	66 6	58 6	—	65 6
Foreign	1st	—	—	76 0	—	71 6	70 0
MUTTON :—							
Scotch	1st	—	—	73 0	77 0	72 0	77 6
	2nd	—	—	69 6	74 6	62 6	57 0
English	1st	68 0	67 0	66 0	70 0	—	—
	2nd	56 0	60 6	63 0	65 6	—	—
Argentine Frozen ...	1st	39 6	41 0	39 6	41 6	39 0	37 6
Australian ,, ...	1st	39 0	38 6	39 0	39 0	—	35 0
New Zealand ,, ...	1st	42 0	—	42 6	—	—	—
LAMB :—							
British	1st	70 6	70 0	74 6	76 0	72 6	79 6
	2nd	66 0	63 0	70 0	70 6	56 0	59 6
New Zealand ...	1st	59 0	56 6	57 0	56 6	62 0	59 0
Australian	1st	53 0	50 6	—	52 0	—	51 6
Argentine	1st	52 6	50 6	—	52 0	—	51 6
PORK :—							
British	1st	63 6	59 0	66 0	60 6	57 6	58 0
	2nd	57 0	54 0	62 0	56 0	52 0	56 0
Foreign	1st	—	—	65 6	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6 ...	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
,, 13 ...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
,, 20 ...	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
,, 27 ...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3 ...	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
,, 10 ...	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
,, 17 ...	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
,, 24 ...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2 ...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
,, 9 ...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
,, 16 ...	32	6	30	1	34	0	23	6	24	11	31	2	18	0	17	6	21	8
,, 23 ...	32	9	30	2	34	1	23	7	25	0	31	10	17	11	17	5	21	9
,, 30 ...	33	0	30	3	34	4	23	8	24	11	30	3	18	0	17	5	21	8
Apl. 6 ...	33	6	30	4	34	10	23	1	24	7	30	9	17	11	17	7	21	11
,, 13 ...	33	7	30	3	35	4	23	5	25	2	30	2	18	3	18	3	22	1
,, 20 ...	33	7	30	4	36	7	23	0	25	5	29	11	18	3	17	10	22	4
,, 27 ...	33	0	30	11	37	10	22	10	25	5	30	4	18	3	18	3	22	9
May 4 ...	32	6	31	4	38	1	22	7	25	7	30	2	18	2	18	6	23	1
,, 11 ...	32	1	31	8	37	11	22	0	25	1	31	1	18	1	19	0	23	7
,, 18 ...	31	10	32	6	37	8	21	8	25	4	31	2	17	8	19	2	23	7
,, 25 ...	31	3	32	8	37	2	21	4	25	0	31	1	17	10	19	5	23	7
June 1 ...	30	2	32	5	36	10	21	8	24	10	30	0	17	10	19	5	23	9
,, 8 ...	29	1	32	4	36	11	20	9	25	7	29	11	17	10	19	7	24	0
,, 15 ...	29	0	32	3	37	0	18	11	23	11	30	8	18	0	19	8	23	10
,, 22 ...	29	4	31	11	37	5	20	1	23	9	30	8	17	9	19	10	24	0
,, 29 ...	29	9	31	10	37	10	19	11	24	5	30	2	17	7	19	9	23	11
July 6 ...	30	4	32	1	38	2	19	5	25	10	31	7	17	4	19	9	23	11
,, 13 ...	31	1	32	3	38	3	21	3	25	10	30	2	17	7	19	11	24	1
,, 20 ...	31	11	32	5	38	10	19	9	24	3	30	9	17	5	19	5	24	8
,, 27 ...	33	5	32	5	38	9	20	10	23	8	30	9	18	1	19	7	23	4
Aug. 3 .	33	9	32	0	38	4	20	5	24	4	28	6	18	3	18	2	22	2
,, 10 ...	33	5	31	6	39	2	20	4	26	9	30	7	18	0	18	0	22	4
,, 17 ...	32	11	31	6	38	2	20	11	27	8	28	3	17	11	17	10	21	8
,, 24 ..	32	7	31	8	35	6	20	10	28	10	28	1	17	2	18	0	20	10
,, 31 ...	32	2	31	7	34	10	22	10	28	4	28	6	17	2	18	3	20	8
Sept. 7 ...	31	11	31	10	35	1	23	3	28	4	29	9	17	2	18	1	21	8
,, 14 ..	30	11	32	0			24	3	29	0			16	6	18	5		
,, 21 ...	30	2	32	4			24	2	29	11			16	3	18	9		
,, 28 ..	30	1	32	6			24	4	30	5			16	4	19	1		
Oct. 5 ...	30	1	32	7			24	7	30	9			16	3	19	5		
,, 12 ...	30	2	32	9			25	1	31	0			16	2	19	10		
,, 19 ...	30	4	32	9			25	3	31	5			16	1	19	11		
,, 26 ...	30	4	33	1			25	4	31	7			16	2	20	6		
Nov. 2 ...	30	4	33	4			25	6	31	10			16	2	20	8		
,, 9 ..	29	11	33	4			25	4	32	7			15	11	20	11		
,, 16 ...	29	8	33	1			25	1	32	10			16	1	21	0		
,, 23 ..	29	11	33	0			24	10	33	5			16	4	20	10		
,, 30 ..	30	6	32	10			24	7	33	10			16	7	20	11		
Dec. 7 ...	30	9	32	9			24	3	34	0			16	9	20	9		
,, 14 ...	30	7	32	11			23	9	33	5			16	10	20	9		
,, 21 ...	30	7	32	9			23	10	33	5			16	9	20	8		
,, 28 ...	30	5	33	0			23	9	33	4			16	9	20	7		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1911.	1912.	1911.	1912.	1911.	1912.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	July	43 8	54 4	26 8	31 3	22 4	24 11
	August	42 4	48 1	26 4	30 3	21 9	23 8
Paris:	July	43 8	56 9	26 6	30 6	23 4	25 0
	August	43 4	48 0	26 3	30 10	22 11	24 5
Belgium:	June	34 10	39 4	27 4	31 0	21 10	26 9
	July	34 3	39 11	24 2	29 8	21 7	26 10
Germany:	June	42 7	47 11	28 8	34 0	25 0	28 3
	July	43 4	47 10	27 1	30 0	25 1	28 7
Berlin:	June	44 4	49 8	—	—	23 3	26 9
	July	45 8	48 11	—	—	23 2	26 0
Breslau:	June	40 5	45 5	—* 24 9†	—* 31 10†	22 10	25 4
	July	41 6	44 1	—* 24 9†	—* 30 1†	22 11	24 11

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of August, 1911 and 1912.

—	WHEAT.		BARLEY.		OATS.	
	1911.	1912.	1911.	1912.	1911.	1912.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London	32 9	37 9	28 5	28 8	19 3	21 10
Norwich	31 8	36 6	27 9	29 5	18 4	20 11
Peterborough	31 3	36 2	27 7	27 10	17 11	20 8
Lincoln...	31 9	37 1	27 9	30 4	17 11	21 6
Doncaster	31 8	38 4	26 9	—	19 4	24 0
Salisbury	30 11	38 2	25 2	25 6	17 11	21 3

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of August, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	13 9	12 9	—	—	14 0	13 0	15 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	118 6	115 0	117 6	114 0	119 6	116 6	116 6	—
,, Factory ...	108 6	103 0	110 6	103 0	110 0	106 0	—	—
Danish ...	—	—	131 6	127 6	129 6	127 6	126 6	—
French ...	—	—	—	—	124 0	120 6	—	—
Russian ..	109 6	105 0	110 6	108 0	109 6	107 6	106 0	—
Australian ...	113 0	109 0	—	—	115 0	112 6	—	—
New Zealand	—	—	—	—	—	—	—	—
Argentine ...	—	—	—	—	—	—	—	—
CHEESE :—								
British—								
Cheddar ...	74 0	70 6	74 0	70 0	74 0	70 6	68 6	64 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	66 6	61 0	75 0	70 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	66 0	63 0	65 6	63 0	66 0	65 0	66 6	—
BACON :—								
Irish ...	81 0	77 0	80 0	76 6	82 0	78 6	79 0	—
Canadian ...	73 0	69 6	72 0	69 0	73 0	71 6	74 0	72 0
HAMS :—								
Cumberland ..	—	—	—	—	104 0	100 0	—	—
Irish ..	—	—	—	—	104 6	100 0	105 0	103 0
American (long cut)	64 0	62 0	64 0	60 0	68 0	62 0	64 6	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	12 1	11 3	—	—	12 8	11 8	12 8	—
Irish	11 2	10 6	10 9	9 9	11 6	10 4	11 4	10 6
Danish ...	—	—	10 8	9 11	11 7	10 4	11 4	10 11
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
British Queen	91 6	85 0	66 6	61 6	80 0	71 6	70 0	—
Other Second Earlies	90 0	80 0	—	—	73 6	71 6	70 0	—
Edward VII.	96 6	86 6	66 6	61 6	83 6	73 6	—	—
HAY :—								
Clover ...	90 0	80 0	103 6	86 0	119 6	93 6	65 6	56 0
Meadow ...	80 0	75 0	—	—	109 0	88 0	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	AUGUST.		EIGHT MONTHS ENDED AUGUST.	
	1912.	1911.	1912.	1911.
Anthrax:—				
Outbreaks	37	69	566	584
Animals attacked	42	89	643	731
Foot-and-Mouth Disease:—				
Outbreaks	15	1	70	8
Animals attacked	128	5	412	425
Glanders (including Farcy):—				
Outbreaks	14	18	122	132
Animals attacked	20	21	235	312
Parasitic Mange:—				
Outbreaks	115	—	2,348	—
Animals attacked	228	—	5,167	—
Sheep-Scab:—				
Outbreaks	8	3	173	307
Swine-Fever:—				
Outbreaks	191	200	2,218	1,768
Swine Slaughtered as diseased or exposed to infection ...	2,910	2,563	28,901	20,798

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	AUGUST.		EIGHT MONTHS ENDED AUGUST.	
	1912.	1911.	1912.	1911.
Anthrax:—				
Outbreaks	1	1	3	7
Animals attacked	1	7	3	14
Foot-and-Mouth Disease:—				
Outbreaks	8	—	24	—
Animals attacked	38	—	236	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	3
Parasitic Mange:—				
Outbreaks	4	6	51	50
Sheep-Scab:—				
Outbreaks	—	8	263	253
Swine-Fever:—				
Outbreaks	20	15	177	92
Swine Slaughtered as diseased or exposed to infection ...	93	197	1,474	1,579

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

The Methods employed in testing Grass Seeds, *G. H. Pethybridge.* (Jour. Econ. Biol., Vol. 7 No. 2.) [63.1951.]

Zur Kalianalyse, *E. A. Mitscherlich* und *Hermann Fischer.* (Landw. Vers. Stat., Bd. LXXVIII., Heft 1 u. 2, 1912.) [543.]

Neue Beobachtungen über das Verhalten von Nitrat im Ackerboden, *Dr. Vogel.* (Centbl. Bakt. [etc.], 2e Abt., 34 Bd., No. 18/22, 1912.) [63.113.]

Studies in Soil Bacteriology. V.—The Nitrifying and Ammonifying Powers of North Carolina Soils, *F. L. Stevens* and *W. A. Withers.* (Centbl. Bakt. [etc.], 2e Abt., 34 Bd., No. 8/9, 1912.) [63.115.]

Die Säureausscheidung der Wurzeln und die Löslichkeit der Bodennährstoffe in kohlensäurehaltigem Wasser, *Th. Pfeiffer* und *E. Blanck.* (Landw. Vers. Stat., Bd. LXXVII., Heft 3 u. 4, 1912.) [63.161; 63.113.]

Beitrag zur Frage über die Wirkung des Mangans auf das Pflanzenwachstum, *Th. Pfeiffer* und *E. Blanck.* [63.167.] Studien über Cuscuta-Arten. II., Infektionsversuche mit Grobseide- (*Cuscuta suaveolens*, Ser.) Samen, *A. v. Degen.* [63.259.] (Landw. Vers. Stat., Bd. LXXVII., Heft 1 u. 2, 1912.)

Kritische Betrachtungen über Humussäuren, Humus und Humusböden, *H. Süchting.* (Fühling's Landw. Ztg., 15 Juli, 1912.) [63.113.]

Ueber neuere Methoden der Bodenanalyse und der Bestimmung der Kolloidstoffe im Boden, *R. van der Leeden* und *F. Schneider.* (Internat. Mitt. Bodenkunde, Bd. II., Heft I., 1912.) [63.113.]

Field Crops—

Catch Crops. (Jour. Dept. Agr. Tech. Instr. Ireland, July, 1912.) [63.33.]

The Hereditary Characters in the Potato, *Dr. Redcliffe Salaman.* (Jour. Roy. Hort. Soc., July, 1912.) [575.1; 63.512(04).]

Der Einfluss einer Zuckergabe auf die Ertragsfähigkeit eines Bodens, *Th. Pfeiffer* und *E. Blanck.* (Mitt. Landw. Inst. Breslau, Bd. 6, Heft IV., 1912.) [63.3432.]

Horticulture—

Recherches sur la Graisse des Cidres, *E. Kayser.* (Ann. Inst. Nat. Agron., 2e Série, Tome XI., Fasc. 1er, 1912.) [663.3.]

Plant Diseases—

L'Entomologie Forestière—2—Sapin Blanc (*Abies pectinata,* D.C.), *A. Barbey.* (Ann. Sci. Agron., Juin, 1912.) [63.27-49.]

Remarks on an apparently new Apple Pest (*Lyguspratensis*, Linn.), *W. E. Collinge.* (Jour. Econ. Biol., Vol. 7, No. 2.) [63.27.]

Weitere Studien über die physiologische und fungicide Wirkung der Kupferbrühen bei krautigen Gewächsen und der Johannisbeere, *R. Ewert.* (Ztschr. Pflanzenkrank, XXII. Bd., Heft 5, 1912.) [63.295.]

Contributions from the Wisley Laboratory:—XVI., Bruise in Potato, *A. S. Horne.* (Jour. Roy. Hort. Soc., July, 1912.) [63.21.]

Live Stock—

Negerkorn als Futtermittel, *Prof. Dr. Hansen.* (Mitt. Deut. Landw. Gesell., 15 Juni, 1912.) [63.604(*a*).]

The Inheritance of the Dun Coat-Colour in Horses, *J. Wilson.* (Sci. Proc. Roy. Dublin Soc., Vol. XIII. (N.S.), No. 14, Jan., 1912.) [575.1; 63.61.]

Untersuchungen über die steirischen Bergschecken und ihre Stellung im Zootechnischen Systeme, *E. Kaserer.* (Mitt. Landw. Lehrk., K. K. Hochsch, Bodenkul., Bd. I., Heft 2.) [63.6(436); 63.62.]

Untersuchungen über den Wert von gewöhnlichem und aufgeschlossenem Sägemehl für die tierische Ernährung, *F. Honcamp, B. Gschwendner,* *H. Müllner* und *M. Reich.* (Landw. Vers. Stat., Bd. LXXVIII., Heft 1 u. 2, 1912.) [63.604(*a*).]

The Use and Purchase of Feeding Stuffs. (Jour. Dept. Agr. Tech. Instr. Ireland, July, 1912.) [63.604(*a*).]

Dairying and Food, General—

Über die spezifischen Wirkungen der Futtermittel auf die Milchproduktion, *A. Morgen.* (Landw. Vers. Stat., Bd. LXXVII., Heft 1 u. 2, 1912.) [63.711(*a*).]

Milk Records. [63.711(*b*).] Memorandum on Cow Testing Associations. [63.711(*b*).] (Jour. Dept. Agr. Tech. Instr. Ireland, July, 1912.)

Birds, Poultry, Bees, &c.—

The Food of the Bullfinch (*Pyrrhula europaea*, Vieil), *W. E. Collinge.* (Jour. Econ. Biol., Vol. 7, No. 2.) [59.162.]

Notes on the Inheritance of Colour and other Characters in Pigeons, *L. Doncaster.* [63.656; 575.1.] Second Report on the Inheritance of Colour in Pigeons, together with an Account of some Experiments on the Crossing of certain Races of Doves, with special reference to Sex-limited Inheritance, *R. Staples-Browne.* [63.656; 575.1.] (Jour. Genetics, Vol. 2, No. 2, June, 1912.)

The Preparation and Packing of Table Poultry for Market. (Jour. Dept. Agr. Tech. Instr. Ireland, July, 1912.) [63.75.]

Forestry—

Effects of the Drought of 1911 on Forestry Plantations, *Fraser Story.* (Quart. Jour. Forest., July, 1912.) [63.21; 63.49(04).]

Le Budget des Forêts en Norvège, *H. Perrin.* (Rev. Eaux et Forêts, 1 Juillet, 1912.) [63.49(481).]

Economics—

Agricultural Holdings Act, 1908; Compensation Scale for Unexhausted Improvements and other Matters of Tenant Right. (Jour. Roy. Lancs. Agric. Soc., 1912.) [347(*a*).]

The Break-up of the Village Community in Russia, *Al. A. Tschuprow.* (Econ. Jour., June, 1912.) [333.5.]

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Davis, B. M.—Agricultural Education in the Public Schools [of the United States]: A Study of its Development with special reference to the Agencies concerned. (163 pp.) Chicago: The University of Chicago Press. 4*s.* net. [37(73).]

Hawaii Agricultural Experiment Station.—Bull. 26:—The Function and Distribution of Manganese in Plants and Soils. (56 pp.) Washington, 1912. [63.113.]

Memoirs of the Geological Survey, England and Wales.—The Geology of the South Wales Coalfield. Part III.:—The Country around Cardiff, with a Geological Bibliography of South Wales and Monmouthshire. [Second edition.] (157 pp.) London: E. Stanford, 1912. 2*s.* [55:912.]

Dop, Louis.—Le Présent et l'Avenir de l'Institut International d'Agriculture. (61 pp.) Rome: Institut International d'Agriculture, 1912. [63(0611).]

Board of Education.—Special Reports on Educational Subjects. Vol. 24:—Secondary and University Education in France. (554 pp.) 1911. 3*s.* [37(44).] Vol. 25:—Universities in the Overseas Dominions. (301 pp.) 1912. 1*s.* 6*d.* [378.] London: Wyman and Sons.

New Hampshire Agricultural Experiment Station.—Bull. 156:—Results of

Seed Tests for 1911. (14 pp.) Durham, New Hampshire, 1912. [343.53(*e*).]

Bailey, F. Manson.—The Weeds and Suspected Poisonous Plants of Queensland. (245 pp.) Brisbane, 1906. [63.25; 63.259(02).]

Michigan Agricultural Experiment Station.—Bull. 267:—Michigan Weeds. (279–459 pp.) 1911. [63.259(04).] Tech Bull. 5:—The Usefulness of Curves in the Interpretation of Microbial and Biochemical Processes. (29 pp.) 1910. [576.8.] East Lansing, Michigan.

Newland, H. Osman.—Local Government Handbook on Education. (352 pp.) London: Griffin and Co., 1912. 6*s.* net. [37(42).]

Memoirs of the Geological Survey.—Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for 1911. (90 pp.) London: E. Stanford, 1912. 1*s.* [55:912.]

New York Agricultural Experiment Station.—Tech. Bull. 19:—Phytin and Phosphoric Acid Esters of Inosite. (17 pp.) New York, 1912. [54(04).]

Wisconsin Agricultural Experiment Station.—Research Bull. 23:—Relation of Soil Bacteria to Evaporation. (183–215 pp.) Madison, Wisconsin, 1912. [63.115.]

Oakenfull, J. C.—Brazil in 1911. (395 pp.) Frome and London: Butler and Tanner, 1912. [63(81).]

Iowa Agricultural Experiment Station.—Research Bull. 2:—Some Bacteriological Effects of Liming. (50–107 pp.) [63.115; 63.15.] Research Bull. 3:—(i.) The Chemical Nature of the Organic Nitrogen in the Soil; (ii.) Influence of Various Factors on Decomposition of Soil Organic Matter. (113–154 pp.) [63.113.] Research Bull. 4:—Bacterial Activities in Frozen Soils. (158–184 pp.) [63.115.] Ames, Iowa, 1911 and 1912.

Tasmania, Agricultural and Stock Department.—Bull. 20:—Description of Proclaimed Noxious Weeds. (12 pp.) [63.259(04).] Bull. 21:—A New Weed: The Onion Weed or Wild Onion (*Asphodelus fistulosus*, L.) (4 pp.) [63.259.] Bull. 22:—Proclaimed Weed: Hemlock (*Conium Maculatum*, L.). (5 pp.) [63.259.] Bull. 31:—Noxious Weeds: Purple Calandrinia (*Calandrinia caulescens*, H. B. & K.). 1912. [63.259.] Bull. 32:—Proclaimed Weed: Viper's Bugloss (*Echium vulgare*, L.). (4 pp.) [63.259.] Bull. 34:—Proclaimed Weed: Wild Teazel (*Dipsacus Sylvestris*, Linn.) (3 pp.) [63.259.] 1911 and 1912.

*Royal Commission on University Education in London.**—Fifth Report of the Commissioners. [Cd. 6311.] (4 pp.) ½*d.* Appendix to Fifth Report: Minutes of Evidence, October, 1911–January, 1912, with Appendices and Index. [Cd. 6312.] (276 pp.) 2*s.* 11*d.* London: Wyman and Sons, 1912. [378.]

Potts, H. W.—The Australian Aspect of Agricultural Education. (553–559 pp.) [Reprinted from Vol. XIII., "Australasian Association for the Advancement of Science," 1912.] [37(9).]

E. Suffolk County Education Committee.—Report on the Results of the Experiments carried out at Rendham, Saxmundham, to the end of the Season 1911, together with Particulars of the Agricultural Schemes of the Committee. (23 pp.) Ipswich, 1912.

Field Crops—

Tanner, A. E.—Tobacco: from the Grower to the Smoker. (118 pp. + map.) London: Sir Isaac Pitman and Co. 1*s.* 6*d.* net. [63.3461.]

Canada, Central Experimental Farm.—Bull. 8, Second Series:—Alfalfa Growing in Alberta. (14 pp.) Ottawa, 1912. [63.33(*c*).]

Michigan Agricultural Experiment Station.—Circ. 13:—Winter Vetch as a Cover Crop in Michigan Orchards. (4 pp.) East Lansing, Michigan, 1911. [63.42; 63.33(*d*).]

Federated Malay States, Dept. of Agriculture.—Bull. 15:—Camphor from

Cinnamomum Camphora (the Japanese Camphor Tree)—Cultivation and Preparation in the Federated Malay States. (38 pp.) Kuala Lampur, 1912. [63.348; 63.49–197.]

Iowa Agricultural Experiment Station.—Bull. 128:—Some Data for Oat Growers. (93–127 pp.) Ames, Iowa, 1912. [63.314.]

Hoffmann, Dr. J. F.—Das Getreidekorn: seine Bewertung und Behandlung in der Praxis, nebst Beschreibung von Speicherbauten und ihrem Zubehör. Erster Band:—Die Bewertung des Getreides. (249 pp.) Berlin: Paul Parey, 1912. [63.31.]

South Carolina Agricultural Experiment Station.—Bull. 163:—Changes in Composition of the Oat Plant as it approaches Maturity. (16 pp.) Clemson, S.C., 1912. [63.314.]

U.S. Dept. of Agriculture, Bureau of Plant Industry.—Circ. 90:—Suggestions to Potato Growers on Irrigated Lands. (6 pp.) [63.512(04).] Bull. 235:—Wild Volatile-Oil Plants and their Economic Importance: I.—Black Sage; II.—Wild Sage; III.—Swamp Bay. (37 pp.) [63.342.] Washington, 1912.

Horticulture—

New Hampshire Agricultural Experiment Station.—Bull. 159:—Fertilisers for Carnations. (14 pp.) Durham, New Hampshire, 1912. [63.52.]

New Mexico Agricultural Experiment Station.—Bull. 82:—Growing Denia Onion Seed. (27 pp.) Agricultural College, N.M., 1912. [63.511.]

New York Agricultural Experiment Station.—Bull. 346:—Influence of Crossing in Increasing the Yield of the Tomato. (57–76 pp.) Geneva, New York, 1912. [63.1952; 63.513.]

Oregon Agricultural Experiment Station.—Circ. Bull. 20:—The Pollination Question [Apples and Pears]. (7 pp.) Corvallis, Oregon, 1912. [63.41(*a*).]

Plant Diseases—

Canada, Department of Agriculture.—Bull. 70:—Cutworms [Surface caterpillars] and Army-Worms. (29 pp.) [63.27.] Bull. 9, Second Series:—The Control of Insect Pests in Canada. (13 pp.) [63.292(71).] Ottawa, 1912.

Cornell Agricultural Experiment Station.—Bull. 300:—The Cabbage Aphis (*Aphis brassicæ*, Linn.). (717–746 pp.) Ithaca, New York, 1911. [63.27.]

New Hampshire Agricultural Experiment Station.—Bull. 157:—Some Apple Diseases and their Treatment. [Revised edition of Bull. 144.] (32 pp.) Durham, New Hampshire, 1912. [63.24(41).]

Collinge, W. E.—A Manual of Injurious Insects. (268 pp.) Birmingham: The Midland Educational Co., Ltd., 1912. 12*s*. 6*d*. net. [63.27(02).]

Michigan Agricultural Experiment Station.—Spec. Bull. 53:—Grasshoppers and their Control. (7 pp.) East Lansing, Michigan, 1910. [63.27.]

Hewitt, C. G.—Investigations on Forest Insects and Forest Protection [in Canada]. (3 pp.) [63.27–49.]

Tothill, J. D.—Systematic Notes on North American Tachinidæ. Part I. (5 pp.) [Reprinted from The Canadian Entomologist, Vol. 44, January, 1912.] [59.57; 63.296.]

*Prillieux, E.**—Maladies des Plantes Agricoles et des Arbres Fruitiers et Forestiers causées par des Parasites Végétaux. 2 vols. (421+592 pp.) Paris: Firmin-Didot et Cie., n.d. [63.24(02).]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P. 10–9. 6,000. 9/12. R. C. & S., Ltd.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE

Vol. XIX. No. 7.

OCTOBER, 1912.

THE STUDY OF AGRICULTURAL SEEDS.

W. BORLASE, N.D.A.

Lecturer in Agriculture, Cornwall County Council.

THE sale of farm seeds has not received from the legislature or from the farmer himself the attention which has been given to the sale of artificial manures and feeding stuffs. Purchasers of articles of the two latter classes receive a certain amount of protection from the Fertilisers and Feeding Stuffs Act, and heavy fines are frequently imposed on those who sell fertilisers or foods with invoices in which false statements are made. There is, however, no legislation of the same character in regard to sales of farm seeds. The annual seed-bill of the farm is a comparatively heavy one, and in the case of some crops the cost of the seed exceeds that of the manure applied. The loss caused by using impure seeds, moreover, is in reality more severe than that due to applying a manure of lower quality than has been paid for, for whereas the latter may have an effect on returns for only one season, the former may result in a serious depreciation of the crop for many years, besides causing much trouble and worry to the farmer.

Most agricultural seeds contain impurities, especially those of low price, but it is in those for temporary and permanent pastures, that is, in grass and clover seeds, that the largest percentage and the greatest variety of seeds of weeds are found.

Every spring a large number of samples of such seeds are brought to me by students of our winter agricultural classes for examination, and I am often struck by the low quality of the seeds used by farmers. For this low quality the seed merchant is not wholly to blame, for a few questions will frequently elicit the fact that the cheapest seeds are used, and as little as ten shillings, or even less, is sometimes paid per acre for seeds which are expected to produce a pasture which shall stand and yield a profitable return for four or five years. As a consequence, the farmer gets a high percentage of weeds, and seeds which are old and withered, and a small proportion of the more expensive, long-lived varieties of grasses and clovers. Good samples may generally be obtained by paying a fair price, and it was with the conviction that it is more economical for the farmer to pay one shilling per pound for the best samples than eightpence per pound for inferior, taking into account here *only* the number of good and true seeds that he would get for every shilling spent, that I commenced the complete analysis of the samples brought to me, and the results in nearly every case prove that this is so. The most expensive seeds (per lb.) give the largest number of good seeds for the penny or shilling, and are, therefore, the cheapest from every point of view. "Cheap" and "nasty" are truly synonymous terms when applied to seeds, for cheap seeds abound in weed seeds, and the sowing of them will result in disappointment and loss during the whole life of the pasture.

Samples of clover and of grass seeds were obtained from various sources and analysed, and then mounted on a series of large cards (2 ft. by 1 ft. 9 in.), with the idea that they would be useful for demonstration purposes.

Diagrams Nos. 1, 2 and 3 illustrate three samples of red clover at one shilling, tenpence, and ninepence per pound respectively. In each case one thousand seeds, representing as fairly as possible the seedsman's sample, and showing, too, the appearance of the sample, were taken. The three sets of one thousand seeds were analysed, and the various species found placed in circles, in order to show at a glance the results of the analysis. Diagram No. 1 shows that the sample at one shilling per pound contained 97·1 per cent. of true seeds which were of good shape and colour, and might reasonably be expected to germinate, with 1·7 per cent. of brown and withered seeds (the germination of which was very doubtful,

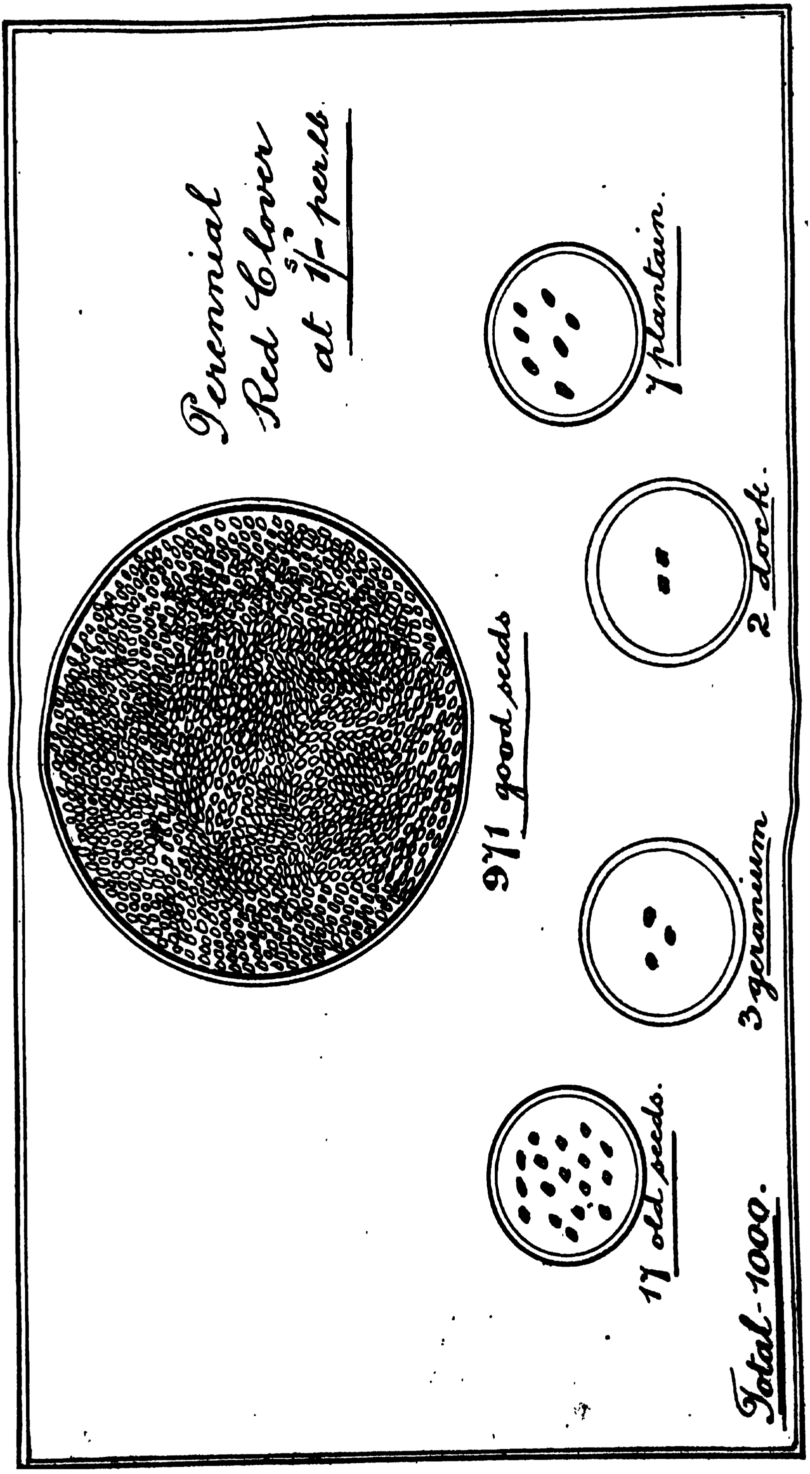

Perennial
Red Clover^s
at 1/- per lb.
971 good seeds
7 plantain.
2 dock.
3 geranium
17 old seeds.
Total–1000.

DIAGRAM NO. 1.

at least), and 1·2 per cent. of weeds. The last included seven plantain, three geranium, and two dock seeds. This represents a low percentage of weeds, and would not be noticed by the untrained man when examining the sample with the naked eye, but it is quite sufficient to make its presence known and felt in the field. If we estimate the number of seeds sown on an acre to be 10,000,000, and the weed seeds to be 1 per cent. of this number, we get 100,000 weed seeds per acre, or about twenty to each square yard. It will be well to bear this figure in mind when considering other samples.

Diagram No. 2 shows the analysis of the sample at tenpence per pound. This gave 78·6 per cent. of good seeds, with 13·4 per cent. of inferior, and 8 per cent. of weed seeds, which include thirty-eight plantain, four field madder, three ox-eye daisy, &c.

Diagram No. 3 shows the analysis of the sample at ninepence per pound. It contained only 60·3 per cent. of good seeds, 28·1 per cent. of inferior, and 11·6 per cent. of weed seeds, &c. If the whole of the seeds sown for the production of the pasture were equally impure there would be 1,160,000 weed seeds to the acre, or about 240 to the square yard. If the farmer would mark out a square yard of ground and arrange 240 stones on it, it would probably assist him to realise the seriousness of the danger he incurs, and the trouble he invites by purchasing seeds with 11 per cent. of weed seeds. Putting the number of red clover seeds in a pound at 220,000, the sample at a shilling per pound gives 17,801 good seeds for a penny, that at tenpence gives 17,292, and that at ninepence 14,740.

Sample.	Price per lb.	Percentage of good seeds.	Percentage of inferior seeds.	Percentage of weed seeds.	Number of good seeds per lb.	Number of good seeds for a penny.
	s. d.					
No. 1 ...	1 0	97·1	1·7	1·2	213,620	17,801
No. 2 ...	10	78·6	13·4	8·0	172,920	17,292
No. 3 ...	9	60·3	28·1	11·6	132,660	14,740

It will be observed that the number of brown and withered seeds increased very rapidly as the price per pound was reduced, much more rapidly than the percentage of weed seeds, which seems to indicate that the cheaper samples contain old seeds—remnants of the preceding year's sales.

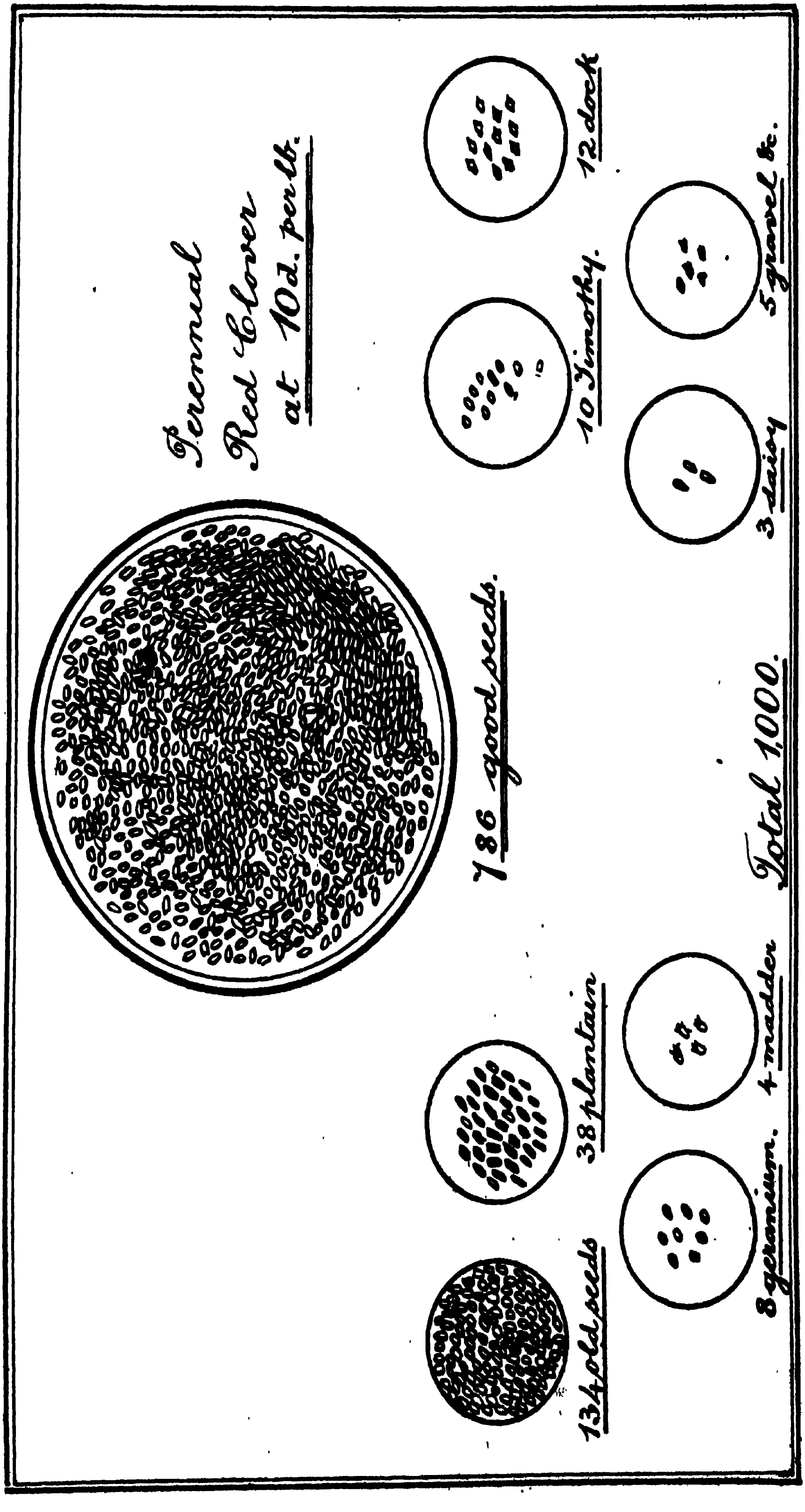

Perennial
Red Clover
at 10d. per lb.
786 good seeds.
134 old seeds
38 plantain
10 Timothy.
12 dock
8 geranium.
4 madder
Total 1,000.
3 daisy
5 gravel &c.

DIAGRAM NO. 2.

The next series of diagrams shows two samples of alsike and two of white clover, treated similarly. The first sample of alsike (Diagram No. 4, *a*) is a very good one, especially so for a season which was so productive of inferior samples. It contains only 0·2 per cent. of weed seeds, and is of good colour and appearance. The proportion of inferior seeds, not weeds, is also very low—1·7 per cent.

The second sample of alsike (Diagram No. 4, *b*) is a very curious-looking one, even to the naked eye, as it contains 20 per cent. of yellow trefoil—conspicuous here by reason of its colour and superior size. Though not to be classed with the weeds, yellow trefoil is unwelcome here seeing that the price per pound is much less than that of the alsike. This is a badly-cleaned sample, for it contains 12 per cent. of weed seeds in addition to the trefoil impurity.

The samples of white clover (Diagram No. 5) contain nothing very striking. The first sample (*a*) is a very good one, giving 98·5 per cent. of good, true seeds, with 0·5 per cent. of weed seeds. The second (*b*) has 82·8 per cent. of good seeds and 4·6 per cent. of weed seeds. These samples serve to show again that the higher priced seeds give the largest number of good seeds for a penny. In the following table the number of seeds in a lb. of alsike has been taken as 720,000, and of white clover as 732,000.

Sample.	Price per lb.		Percentage of good seeds.	Percentage of inferior seeds.	Percentage of weed seeds.	Number of good seeds per lb.	Number of good seeds for a penny.
	s.	*d.*					
Alsike No. 1 ...	1	0	98·1	1·7	0·2	706,320	58,860
„ No. 2 ...		10½	53·1	34·9	12·0	382,230	36,402
White Clover, No. 1	1	1	98·5	1·0	0·5	721,020	55,463
„ „ No. 2		11½	82·8	12·6	4·6	606,096	52,704

Another collection of samples represents "mixtures" of seeds for temporary "leys" or pastures. It was the almost invariable rule a few years ago, and it is still a common practice, for the farmer to purchase his seeds of the seedsman at so much per acre, and to receive them mixed and ready for sowing. This is not a wise practice, and it is gratifying to find that the number of those who insist on receiving the

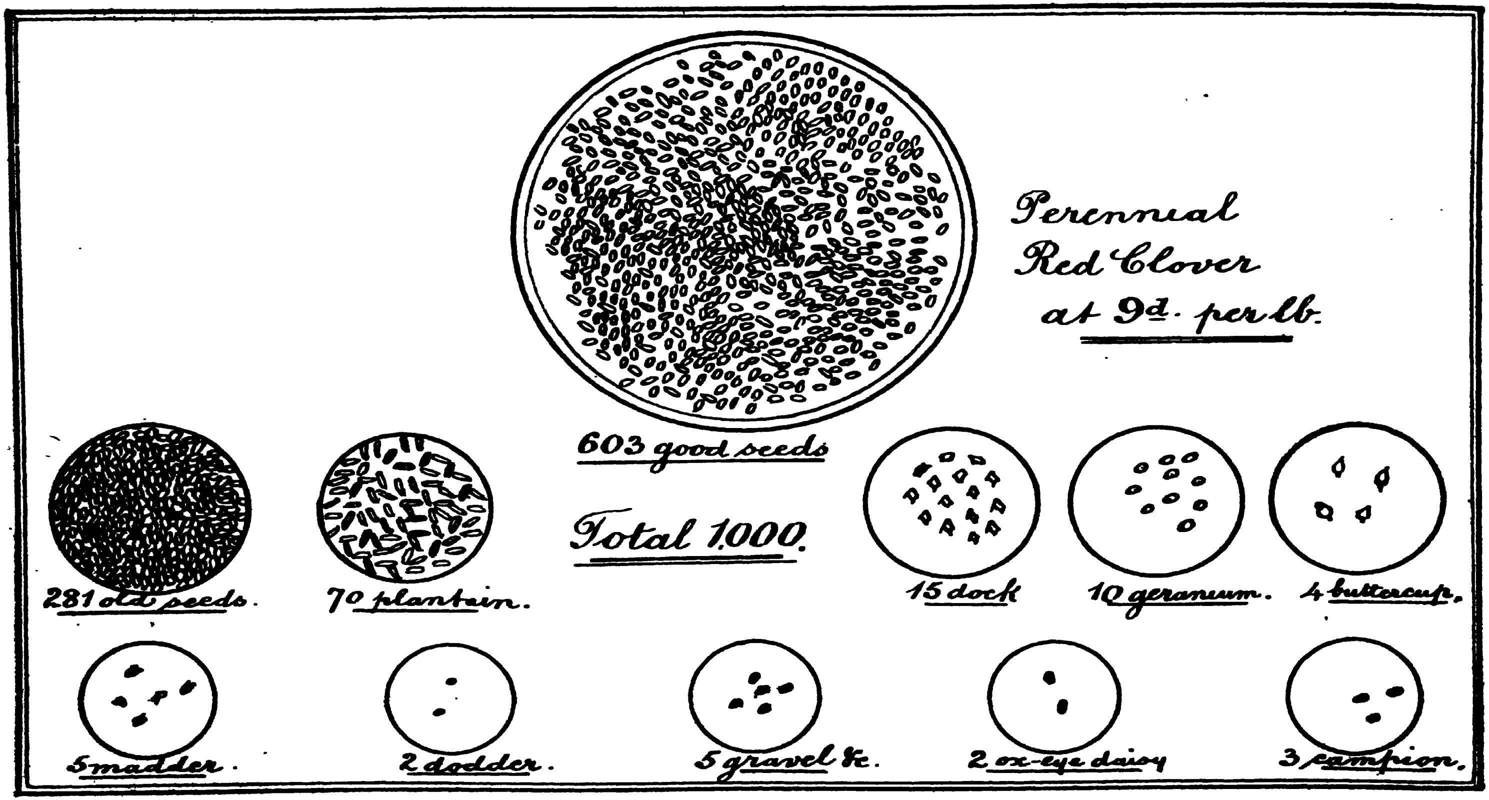

Perennial
Red Clover
at 9d. per lb.
603 good seeds
Total 1,000.
281 old seeds.
70 plantain.
15 dock
10 geranium.
4 buttercup.
5 madder.
2 dodder.
5 gravel &c.
2 ox-eye daisy
3 campion.

DIAGRAM No. 3.

different species of grass and clover seeds in separate packages is increasing. In the first place, it must be a temptation to unscrupulous dealers to supply seeds of low quality, for the difficulty of estimating the value of samples of seeds is very much increased by mixing them together. The first step towards arriving at such an estimate must be the separation of the various species, and a comparatively large quantity of the mixture must be sorted out in this way to obtain a fair sample of each species in order to make the calculation at all trustworthy. In the second place, as the merchant is allowed to include in the mixture just the kinds and quantities he considers best, often without any particular knowledge or consideration of the soil and situation for which the seeds are intended, the results are often unsatisfactory, and the pasture deteriorates so rapidly—chiefly through the inclusion of large proportions of the cheap, short-lived species in the mixture—that it soon has to be brought again under the plough.

In the first sample of mixtures—one recommended for a "three-years' ley"—there were 707 good grass seeds and 186 good clover seeds; of inferior seeds there was a total of 203, and of weed seeds—rat's-tail fescue, 27; soft brome, 24; plantain 29; various, 20; total, 100. The complete analysis is as follows:—

Total number of Seeds in Sample, 1,196.

Good Seeds.		
Perennial Rye grass	496	74·6 %
Italian ,, ,,	75	
Cocksfoot	81	
Timothy	55	
Red Clover	103	
Alsike and White Clover	72	
Yellow Trefoil	11	
Total	893	

Inferior Seeds.		
Perennial Rye Grass	130	17 %
Italian Rye Grass, &c.	8	
Red Clover	31	
Alsike, &c.	34	
Total	203	
Weed Seeds	100=8·3 %	

The proportion of clovers is too low; for a pasture of such a short duration there might well be twice that percentage, but a higher proportion of clovers would make the mixture more expensive. The percentage of weed seeds is very high when we consider the price charged—16*s*. 6*d*. per acre—and the small proportion of the more expensive seeds in the mixture.

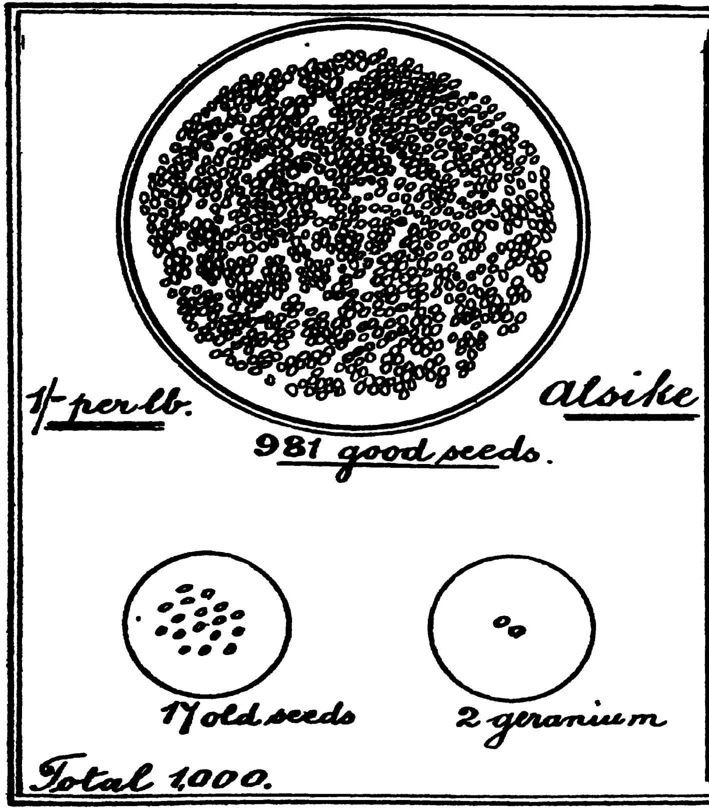


DIAGRAM NO. 4, *a*.

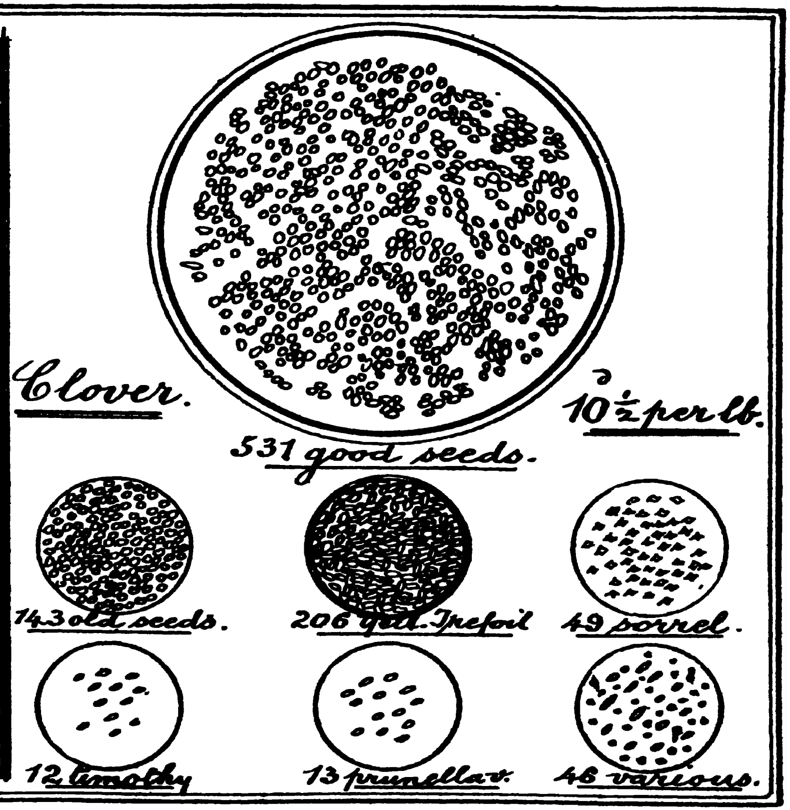


DIAGRAM NO 4. *b*.

In a second sample, a mixture for a five-years' ley, there were the following :—

Total number of Seeds in Sample, 1,929.

Good Seeds.		
Perennial Rye Grass	360	86 %
Cocksfoot	164	
Meadow Foxtail	52	
Timothy	228	
Meadow Fescue	123	
Hard Fescue	63	
Meadow Grasses (*Poa* sp.) ...	123	
Red Clover	150	
Alsike and White Clover ...	396	
Total	1659	

Inferior Seeds.		
Red Clover	69	10·26 %
Alsike, &c., &c.	129	
Total	198	

Weed Seeds.		
Plantain, &c.	28	3·73 %
Soft Brome	29	
Rat's-tail Fescue.	15	
Total	72	

Although the proportion of weed seeds is much lower than in the first sample, and the proportion of clovers more nearly what it should be, the percentage of inferior seeds is very high, particularly in the clovers, and this cannot be considered a good sample for the price charged—22*s*. 6*d*. per acre. Doubtless the farmer could make a better and cheaper mixture by purchasing the various species separately.

Another example may be taken from the analysis of two very inferior samples of seeds which were offered for sale in the spring of 1910. Both were advertised as "screenings," and the clover was said to contain "50 per cent. of large, bold, good-growing seeds," suitable for poor, rough land. The price was low, to match the quality, and were it not for the extreme folly of introducing so many weed seeds to the farm, one might allow the purchase of such rubbish to pass without comment. Analysis proved that the first sample contained 32 per cent. of good red clover seeds, 36 per cent. of really worthless seeds, and 32 per cent. of weed seeds which included (per 1,000 seeds in the sample) :—

Hedge Parsley	159	Plantain	86
Field Madder	40	Various	39

The second sample was much inferior to this : (1) Good seeds (chiefly *Lolium* sp. and *Poa* sp.), 14·2 per cent.; (2) Inferior seeds, 168 or 20·2 per cent.; and (3) Seeds of weeds, which included (per 830 seeds in the sample) :—

Rat's-tail Fescue	123	Gravels that could be counted = 60 ; leaving 484 weed seeds, or 58·3 per cent.
Plantain	103	
Annual Meadow Grass	53	
Various Weeds, Gravel, &c. ...	265	
Total	544	

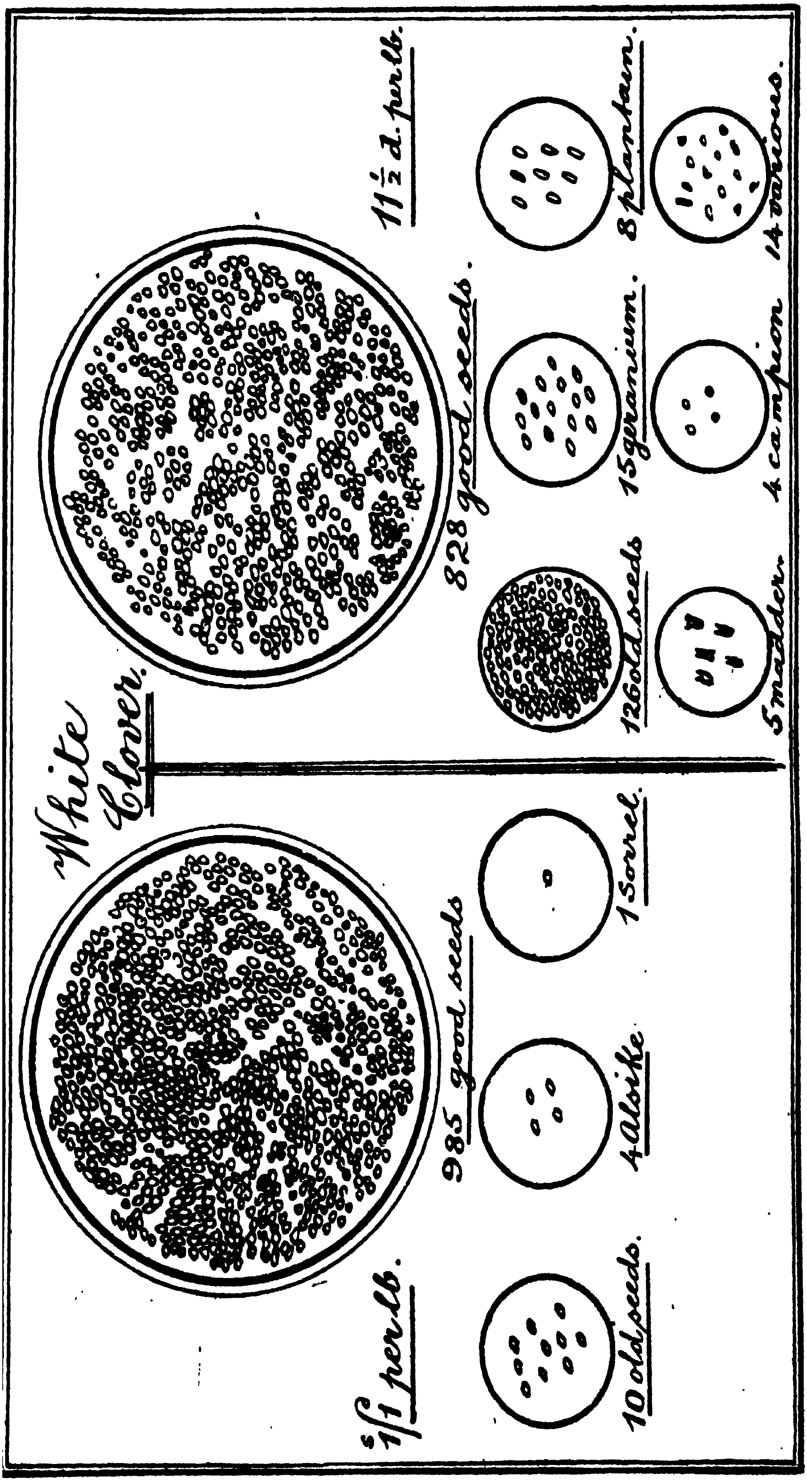


DIAGRAM NO. 5, *a*.

DIAGRAM NO. 5, *b*.

There was also a large quantity of dust and sand that could not be counted.

If, as we have all heard, "one year's seeding means seven years' weeding," these seeds are calculated to supply some work for the future for those using them. It is evident that, regardless of the result secured, farmers can still be found who will purchase anything in the nature of seeds, provided they can be got for little money, the quality of the sample being judged after tillage by the ability to cover the soil with something green in a short time.

The above analyses prove the importance of testing seeds. The amount of money wasted every year through the use of seeds of low quality is enormous. Many samples contain 5 per cent., or more, of seeds which are old and withered, and consequently will not germinate even in the most favourable season. This is a dead loss to the farmer, but the injury so caused is trifling compared with that produced by the presence of the 3–5 per cent. of weed seeds quite as frequently found, for in them we have an evil the influence of which does not cease, but rather begins with the burying of the seeds in the soil. From them will be produced plants, worthless in themselves, which will enter into competition with the desirable plants of the pasture for soil food, air, light, and space, and which will demand the expenditure of much thought and labour on the part of the farmer to keep them in check. During the whole of the period the pasture is allowed to stand the evil continues, frequently increasing in intensity with age, so that the farmer is often compelled to "break" a ley, which, but for its weedy condition, he might have been able to keep down with profit for years. Then there is the annual loss on the pasture caused by the presence of these weeds to be considered, and this loss has been estimated by one authority to be not less than 2*s.* 6*d.* per acre per annum on an average. In Cornwall alone there are about 195,000 acres of temporary pasture, and an annual loss of 2*s.* 6*d.* per acre on this area means an annual loss to the farmers of the county of £24,000. The loss for the whole country, reckoned in the same way, must be very large.

A great deal may be done to remedy the evil by means of lectures and demonstrations. Some progress has already been made in this direction in the winter agriculture classes under the Cornwall County Council. Early in 1912 there were about 350 students in these classes, and every student makes for himself, under the direction of the teachers, a collection of seventy-two kinds of agricultural seeds mounted on stiff cardboard. The task of mounting is performed in the classroom, and working rapidly and methodically it occupies only three hours. This card the student keeps at home, and by its help, supplemented with that of a pocket lens, he sorts out and names the varieties of seeds in a mixture of from six to ten kinds supplied to him weekly at the class. No part of the work of the class is enjoyed more than this, and abundant evidence is forthcoming to show that it is bearing fruit. Though few may become adepts at analysing seeds, all are being impressed with the necessity for care in their selection and purchase, and the majority would have no difficulty in identifying and naming specimens of the twenty or thirty most common grass and clover seeds used on their farms.

THE THIRTY YEARS' RECORD OF A GRASS ORCHARD.

C. H. HOOPER, F.S.I.

Cherries in Kent are chiefly grown in grass orchards, being either first planted on arable land, to be laid down to grass some ten years later, or planted direct into pasture. In either case the grass is grazed by sheep and not mown. The following is an account of an orchard, chiefly of cherries, extending over thirty years, and shows the actual returns and the method of cultivation adopted during that period.

The orchard is situated in the parish of Sheldwich, near Faversham, in Kent—a district noted for its cherries—and from this orchard are sent some of the finest cherries that enter Covent Garden. It is interplanted with some apples, plums, and pears, with damsons in the hedges. The orchard has been carefully treated, planted up, and inferior sorts regrafted, so that it has much improved during the last thirty years.

Soil.—The area is about 4½ acres, and the depth of soil and subsoil varies from 5 to 8 feet over the chalk. The top soil is a loam about 2 to 2½ feet thick, and the subsoil is a brick earth * 1½ to 4½ feet thick, under which is about a foot of flints mixed with clay; then comes solid chalk, which must be of a great depth, there being a well on the property 140 feet deep through chalk. The natural drainage of the orchard is good. It slopes slightly towards the east, and stands about 227 feet above sea-level.

Planting.—It is thought that the land has been under grass for several hundred years, and the oldest cherry and apple trees and the two walnut trees seem to be about 80 years old. The trunk of the oldest cherry tree has a circumference of nearly 4 ft. The cherry trees were originally planted 34 by 32 feet apart, and about twenty-six years ago eighty standard apple, cherry, and plum trees were put in to fill up blanks, and plums were interplanted between the rows of cherries. No pains were spared in the planting of the cherries, as it was realised that they were to be there for seventy years. Good trees were purchased, and holes four feet square and two feet deep were dug, brickbats being put in where it was thought drainage might be necessary. Stakes were first driven in, then good loam was put in the holes, and the trees were planted near the surface. This treatment was successful, and the trees are now beautiful, some of the Napoleon cherries bearing about eight half-bushels of fruit. Galvanised wire netting has been placed round their trunks up to about 2½ feet from the ground, to prevent sheep and lambs gnawing the bark.

Regrafting.—A good many of the original cherry trees were regrafted, chiefly with the Napoleon and Waterloo varieties. Two trees of Adam's Crown were regrafted because their fruit matured earlier than that of any of the other varieties, and it was not worth while starting bird-scaring for two trees. The trees that were regrafted more than twenty years ago are now at their prime.

Yield.—The 97 cherry trees consist of 56 Bigarreau Napoleon, 19 Amber Bigarreau, 10 Early Black, 7 Waterloo,

---

* Samples of the top soil and the subsoil at 2½ feet from the surface have been analysed for lime at the Wye Agricultural College. The surface soil contains only 0·028 per cent. of lime and the subsoil only 0·01 per cent., so that the soil is exceptionally deficient in lime. This small percentage of lime does not, however, seem to affect the quantity or size of fruit, or the growth of the grass; although a fair proportion of lime in the soil is generally considered essential to success with stone fruit.

1 Turk, 1 Frogmore, 1 Morello, and 2 Kentish preserving cherries. In thirty years these trees have yielded 6,529 half-bushels of fruit, which sold in Covent Garden for £1,654, the average price for the period being 5*s.* 1*d.* per half-bushel, with about 3*d.* rail and 3*d.* sale expenses to be deducted. The average yield per tree per annum over thirty years equals 2 halves 1 gallon, or 11*s.* 4½*d.*, less rail and sale expenses.

The 61 apple trees include the following varieties (placed approximately in the order of sending to market): Quarrenden, Jennetting, Suffield, Worcester Pearmain, Hawthorndon, Warner's King, King of the Pippins, Lady Henniker, Cox's Orange, Royal Russet, Claygate Pearmain, Blenheim Orange, Wellington, Bramley, Annie Elizabeth, Golden Knob, Nonpareil, and Lane's Prince Albert. The yield of fruit in 24 years was 1,188 bushels, selling for £226, at an average price of 3*s.* 10*d.* per bushel, giving an average annual yield per tree over 24 years of 3¼ pecks, value 3*s.* 1*d.*

The 29 pear trees in 22 years yielded 526 bushels, selling for £98, the average price for the whole period being 3*s.* 8½*d.* per bushel, and the average yearly yield per tree over 22 years 3¼ pecks, value 3*s.* 1*d.*

The 96 plum trees, Rivers' Early Prolific, Early Orleans, Victoria, Grand Duke, Belgian Purple (in approximate order of ripening), yielded in 13 years, 606 halves, selling for £63 4*s.*, the average price per half being 2*s.* 1*d.*, and the average yield per tree over 13 years 1 peck, value 1*s.* 0*d.*

The 50 damson trees in hedges in 7 years yielded 104 halves, value £10 8*s.*, the average price for the last 7 years being 2*s.* 0*d.* per half, and the annual average yield per tree over the 7 years 1¼ gallon, value 7*d.*

The two large walnut trees (one bearing soft-shelled walnuts, the other very hard) yielded in 30 years 340 bushels, selling for £69 8s., the average price per bushel being 4*s.* 1*d.*, and the average yield per tree 5½ bushels, value 23*s.* All the walnuts that can be conveniently gathered green are sent in husk; the trees being very tall, the rest are threshed off later in the year, two men generally threshing them in a day for 8*s.*

The total gross sale price for the produce of the orchard in the 30 years was £2,121, and the amount actually received

SUMMARY OF YIELD OF FRUIT AND MONEY RETURN FOR 30 YEARS FROM A GRASS ORCHARD AT SHELDWICH, Nr. FAVERSHAM, KENT.

——	Total yield in 30 years, 1882 to 1911.	Selling Price at Covent Garden.	Average selling price.	Average yield per annum.*	Average money return per annum.	Average annual yield of fruit per tree.	Average money return per tree per annum.
		£ s. d.	s. d.		£ s. d.		£ s. d.
97 Cherry trees yielded	6,529 half bushels in 30 years	1,654 6 5	5 1 per half bushel	218 half bushels	55 2 10	1 bushel 1 gallon	11 4½
61 Apple trees ,,	1,188 bushels in last 24 years	226 2 0	3 10 per bushel	49½ bushels	9 8 5	3⅓ pecks	3 1
29 Pear trees ,,	526 bushels in last 22 years	98 0 6	3 8½ per bushel	24 bushels	4 9 1½	3⅓ pecks	3 1
96 Plum trees ,,	606 half bushels in last 13 years	63 4 0	2 1 per half bushel	46½ half bushels	4 17 3	1 peck	1 0
50 Damson trees in hedges ,,	104 half bushels in last 7 years	10 8 3	2 0 per half bushel	15 half bushels	1 9 9	1¼ gallons	7
2 Walnut trees ,,	340 bushels in 30 years	69 8 6	4 1 per bushel	11½ bushels	2 6 4	5½ bushels 1 gallon	1 3 2
		2,121 9 8					
Less rail and sale expenses (about 3*d.* each per half bushel = 13⅓% or 2*s.* 8*d.* in £ on gross sale price)		272 6 9					
Nett return from sales ...		£1,849 2 11	= Nett average yearly return		£61 12 9		
+ Consumed in house on an average £7 fruit yearly, in 30 years... ...		210 0 0	Value of fruit consumed yearly in house ...		7 0 0		
Nett total		£2,059 2 11	Total average return per annum ...		£68 12 9	÷ 4¼ acres = per acre	16 3 0
						+ Sheep pasturage, say	2 7 0
						Total yield of orchard per acre per annum ...	£18 10 0

* The addition of the amount of fruit consumed in the house would raise the yield by nearly 10 per cent.

from Covent Garden was £1,849, leaving £272 for rail and sale expenses, equal to 13½ per cent. To this total receipt should be added £210, equal to an average of £7 yearly, being the estimated value of fruit consumed in the owners' household, making a net gross total of £2,059, or an average of £68 13*s*. per annum. The average yield per acre for the 30 years was £16 3*s*., to which must be added £2 7*s*. rent for sheep pasturage, making a gross total of £18 10*s*. per acre.

Outlay.—The cost of pruning and replanting may be put at, say, 36*s*. yearly. Last spring, just before the leaves opened, the apple trees were sprayed with lime-sulphur wash, and the previous spring with lime-wash spray; the chief insect pest now troublesome is Woolly Aphis. Taking 1911 as an average year, cherry picking cost £17 8*s*. to pick 241 halves; this includes bird-scaring for three weeks before picking, paying the man who moves the ladders and "keeps" the birds 24*s*. per week for five or six weeks, and paying five or six women pickers 2*s*. 6*d*. each per day. In addition there is a gun license, 10*s*. for man scaring birds, and numerous miscellaneous expenses, such as powder and shot, supply and repair of ladders, and spray pump. There is also the insurance of the pickers against accidents (15*s*. for one man and five or six women for five or six weeks, to cover all legal liability), carriage of empty baskets at 1*s*. for 48 half-bushel baskets, cartage to the station, and packing paper for the baskets. These in the aggregate amount to a considerable sum, apart from rent and taxes. The rent of agricultural land in the neighbourhood is £1 10*s*. per acre, and that of the orchard £4 per acre.

A very important factor is the great variation in the returns, due both to the variation in yield and in the price obtained. For instance, it may be mentioned that the net returns from market for the best year, 1902, were £133 7*s*., whilst for 1910, the worst year, they were only £14 16*s*. The average price of the various fruits varied as follows:—

Cherries, from 2*s*. 6½*d*. per half in 1909 to 8*s*. 6*d*. in 1897.
Apples, from 3*s*. per bushel in 1891 to 7*s*. in 1890.
Pears, from 1*s*. 1½*d*. per half in 1909 to 3*s*. 4*d*. in 1884.
Damsons, from 1*s*. 4¾*d*. per half in 1907 to 5*s*. in 1902.
Walnuts, from 2*s*. 2½*d*. per bushel in 1909 to 6*s*. 8*d*. in 1884.

HEDGE-CUTTING AND LAYING.

A. W. OLDERSHAW, B.SC. (EDIN.), N.D.A.

Agricultural Organiser to the East Suffolk Education Committee.

Practical classes in hedge-cutting and laying were conducted during the winter of 1911–12 by the East Suffolk Education Committee, and it is thought that a short description of the work done might be of interest to agriculturists throughout the country.

The system of hedging which prevails in some of the eastern counties is a rather primitive one. The hedges are allowed to grow to a height of, say, 10 to 15 ft. They are then cut off level, at a height of 3 or 4 ft., the brambles, &c., being removed at the same time. The fence remaining after this treatment—locally known as "buckheading"—is really nothing more than a row of live stakes. In the following spring each stake shoots out at the top, and as practically all the shoots proceed from the top of the uprights, the bottom of the hedge becomes thinner and thinner as time goes on, owing to shading from the bushy top. After a number of years, when the fence has become very thin at the bottom, the whole hedge is cut off close to the ground, with the object of inducing a growth of young shoots from the bottom. Most of the hedges of this kind are planted on banks about three feet high, otherwise this treatment would be impossible.

The general result, however, is that in districts where this method of managing the fences is adopted, the large majority of them are very unsatisfactory, and when sheep are folded on the land, it is usually necessary to place hurdles or wire netting along the side of the hedge. In fact, it is difficult to see of what use fences such as these are, and it may be argued with a considerable show of reason that, on purely arable land, the farmer would be better without them.

Although banks are often undoubtedly of use in making a fence, the system of planting hedges on banks possesses certain grave disadvantages, especially on arable land. The banks occupy a considerable area of ground, being frequently 5 or 6 ft. across. In the course of time they become full of the roots of trees, brambles, &c., so that it is quite impossible to keep them free from weeds. These weeds spread their seeds throughout the field and undoubtedly greatly add to the difficulty of keeping the land clean. Even if the weeds are cut down annually with a hook, as they very seldom are, there is no doubt that large numbers of their seeds are distributed throughout the fields. Such banks also harbour noxious insects of various kinds.

The system of hedging as generally practised in the midland counties, and in which instruction has been given by the East Suffolk Education Committee, may now be briefly described.

System of Hedging recommended for Grass Land.—The hedge is allowed to grow to a considerable height, say 15 ft. It is then "laid," and subsequently trimmed annually, until it begins to get weak at the bottom. When this occurs, it is allowed to grow up, the laying being again performed when it has attained a sufficient height to give good long "layers."

In the case of a moderate-sized hedge, the laying may be performed at any time from November to April. Where a big old hedge which has been neglected in the past has to be dealt with, the work should be performed in April, just when the sap is beginning to rise. In the spring time it is found that the layers of an old hedge are less brittle and less liable to break off than in the dead season.

Stakes.—About every 2 or 3 ft. in the hedge an upright stake is necessary, in order to keep the "layers" in their proper position. These stakes may be "dead" or "live." "Dead" stakes, about five feet in length, are cut out of the hedge as opportunity arises. They are driven into the ground until firm, and are then cut until at the general level of the finished hedge. The thickness of the stakes is not a matter of great importance, provided they are strong enough to keep the layers in their proper position.

If live stakes are used, they should be reduced to the desired height and then cut about half-way through at the bottom. The object of this is to encourage young shoots from below the cut and not from the top of the stake. An objection sometimes made to live stakes is that careless or inefficient hedgers frequently neglect to cut their stakes partly through at the bottom, so that many good farmers insist that only dead stakes shall be used. All brambles and undergrowth should be cut away before commencing to lay the hedge.

Layers.—The tallest thorns in the hedge should be used as layers. They should be partly cut through, leaving a tongue, with bark, attached to the parent stump, the thorn being bent over so that it stretches along, and is worked in and out amongst the live stakes. The parent stump should be trimmed clean, so that no ragged portions·project; if this is not done rain will enter the stump and gradually rot it. If dead stakes are used it will frequently be convenient to insert them after some of the layers are down.

The layers should be so arranged that their thorny part projects on that side of the hedge on which there is most danger of damage by cattle, and on the opposite side to that on which the man is working. Some hedgers recommend that the layers be bent over in such a way as to leave the stumps free. If this is done, the growth from the latter does not become entangled with the layers, so that in the course of years, when it is desired to lay the hedge again, difficulty is not experienced in dragging out the old layers. The objection to it, however, is that should land on both sides of the hedge be open to grazing animals, the young shoots from the stumps will be eaten off, so that it will be necessary to erect a dead fence of thorns to protect the shoots.

If the layers are arranged directly over the stumps, the shoots from the latter will find their way amongst the layers, and in the course of years form an almost impenetrable fence —a mixture of layers and upright shoots.

At the end of a hedge, near gateways and trees, and where the fence is very thin, it will frequently be necessary to place some of the layers in an opposite direction to that in which the hedge is being laid. In fact, a skilled man will use every available piece of live thorn in a thin fence, working it into the laid hedge in various directions.

Binding.—After the fence has been laid along its entire length, it is "bound." Brambles, briars, &c., are cut off and twisted along the top of the hedge from stake to stake to keep the layers neat, and in their proper position. These will become rotten in a few years, but then they are no longer needed. Occasionally live material is used for binding. It cannot usually be worked up so neatly, however, as can dead stuff. It may also be noted that live bindings increase the risk of accidents in the hunting field.

Forking out of Hedge-bottoms.—Every year the ground at the foot of the hedges on arable land should, as far as the exigencies of the labour on the farm will permit, be forked over. This serves the important purpose of keeping it free from weeds, which not only choke the hedge, but also contaminate the surrounding land.

When a hedge beside a ditch is laid, the latter should be cleaned out and the mud plastered round the roots of the hedge, in order to protect them, and to keep the soil from gradually falling away.

Subsequent Treatment of Hedge.—After a fence has been laid, it should be trimmed annually with the slasher until such time as it becomes thin at the bottom, after which it may be allowed to grow up to a height of, say, 12 to 15 feet, when it should be again laid.

In pastures, and where it is desired to maintain a good thick fence for shelter, it may occasionally be better not to slash the hedge, but simply to allow it to grow up until it again requires laying. If either of these methods is adopted, a thoroughly good fence should be maintained.

Hedges between Arable Fields.—On arable land much lighter fences than those between grass fields are usually sufficient. The hedge may very well be cut and laid to a height of 3 ft. 6 in., as compared with 4 ft. 6 in. or 5 ft. in the case of grass land.

After laying, the fence should be trimmed annually until it begins to get weak at the bottom, when it may be allowed to grow up to a height of, say, 10 ft., and be again laid.

Neglected Hedges.—It often happens that hedges have been neglected for long periods, and much of the thorn may have died. Where this is the case it may be necessary to replant the thinnest portions.

A really skilful hedger will, however, utilise existing material so that a most unpromising fence may often be restored to a respectable condition in a few years.

Hedging Tools.—In order that hedgers may perform first-class work it is absolutely essential that they should be provided with proper tools.

The principal tools necessary are a bill-hook and a good axe. A pair of strong leather mittens or gloves should also be available.

The bill-hook used should have two cutting edges, the one straight at the back of the hook, the other gradually curved. The straight edge is used for cutting all the lighter wood, the axe being reserved for thorns exceeding four inches in diameter. In some parts of the country a type of bill-hook is used which has only one cutting edge, with a very sharply curved hook at the end. This is a most inconvenient tool, and should be rejected in favour of the type described above.

All tools should be kept extremely sharp, or good clean work cannot be performed.

In the classes conducted by the East Suffolk Education Committee, an expert hedger, who had obtained several prizes, was employed as instructor. He visited the farmers, working for two to three days on each farm, neighbouring farmers sending their men to take part in the work. The men were usually arranged along the hedge in pairs, the instructor going to and fro, assisting and advising as to the method to be adopted. It was found that six pupils were a suitable number to form a class. After working for two or three days with the instructor, any intelligent man, though previously ignorant of this system of hedging, was able to do very fair work indeed.

NAVEL ILL AND JOINT ILL IN NEWLY-BORN ANIMALS*

THIS disease is met with, under such local names as Big Joint, Joint Evil, and Schooley, in most parts of the British Isles.

Cause.—The disease is caused by the entrance into the system of the newly-born animal, through its unclosed navel, of germs which may give rise to the formation of pus or matter. It is possible, however, that germs which are not pus-forming, but which may cause serious illness in animals, may also enter the system by the navel wound. These germs are widely distributed in nature, but are found in greater numbers and probably in a more virulent form on those spots frequently soiled by animals, such as farmyards, lambing yards, &c., than in the fields. For this reason permanent foaling and calving boxes and lambing sheds or sites for temporary yards used frequently are more dangerous places than the pastures.

---

* This is a revised form of Leaflet No. 130, which can be obtained free on application.

Symptoms.—Affected animals are noticed a few days after birth to be moving stiffly and to be disinclined to walk or suck. They lie down continually, and with difficulty are got on to their legs. Their joints begin to swell, and often it is apparent that abscesses have formed—the hock, stifle, point of the shoulder and knee being the joints usually affected. In the worst cases abscesses form in different parts of the body (particularly the kidney and liver), and the animal dies from exhaustion or from the poisons produced by the germs of the disease. Other germs which do not necessarily cause Joint Ill may give rise to blood-poisoning, and kill the animals more quickly, with symptoms of brain trouble and diarrhœa.

Prevention.—Every outbreak on a farm may add to the number of these germs, and so increase the probability of future attacks. On the other hand, if outbreaks are prevented, the germs become fewer in number.

Efforts must be made to prevent the occurrence of cases on a farm by preventing the germs from gaining access to the navels of newly-born animals, and to the system through the imperfectly closed navel. In foals and calves this object is best attained by ligaturing the umbilical cord (navel string) immediately after birth with a piece of strong string which has been soaked in a 5 per cent. solution of carbolic acid in water, or in any equally effective disinfectant, and by applying a disinfectant to the navel in the form of an ointment or in solution.

If an affected animal is housed in a building, the final disinfection of the building and the litter after its removal must be very thorough.

As this disease more often assumes epizootic characters among lambs than among foals and calves, the preventive measures to be adopted to safeguard lambs are given in greater detail.

1. A site for lambing the ewes must be chosen as free from infective material as possible, and there is no doubt, other things being equal, that ewes lambing in the fields rear a greater number of lambs than those in temporary or permanent lambing yards. Shelter, if necessary, can be provided by strawed hurdles set up about the fields in the form of a cross, or arranged to break the prevailing winds. The lambing field should, if possible, be changed each year.

2. The system in vogue in some counties of passing the whole flock of ewes, if a big one, through one lambing yard cannot be too severely condemned. A large flock should be split into as many divisions as convenience will allow; it is then possible to confine disease to the divisions in which it occurs. If the lambing yard system is adopted it is imperative that a fresh site should be chosen each year.

3. All dead lambs and the membranes in which they are born should be buried promptly. Straw on hurdles and for bedding should be renewed occasionally, and hurdles should be lime-washed. Manure and straw from hurdles should be placed in a heap and burned, and should never go on to sheep pastures. At the end of the season the site of the yard should be sprinkled with lime and the hurdles should be lime-washed.

4. Care should be taken that the shepherd does not carry disease from ewe to lamb or from lamb to lamb. A shepherd's hands must be continually and scrupulously cleansed with soap and water. They must also be disinfected, nails being kept short and scrubbed with a nail-brush. His clothes should be covered with a lambing coat, which should be frequently washed and disinfected. Dead ewes or lambs should not be skinned by the shepherd.

5. A little disinfectant should be applied to the navel of each lamb immediately after birth. Stockholm tar has been found useful for this purpose.

6. A ewe which has given birth to a dead lamb should not be allowed to run with the healthy ewes and lambs. If a ewe loses her lamb from this disease it is not safe to "mother" a fresh lamb on to her, as this lamb often becomes attacked. The expedient of putting the skin of a ewe's dead

lamb on another to be adopted by her should on no account be resorted to.

7. Ewes which have lost their lambs should be carefully watched, as it is possible that germs from the lamb may have found their way into her teats and produced inflammation of the udder, which, if it does not kill the ewe, will probably prevent the gland secreting milk in the future, and so render her unfit to breed again.

8. The site of the lambing yard in which diseased lambs became infected should be immediately changed and the hurdles re-strawed and disinfected. If an infected field is believed to be responsible, the sheep should be moved on to fresh ground. In this way it is possible to avert a serious outbreak.

Treatment.—The disease in foals and calves should be treated by a veterinary surgeon, for the animal's life and future usefulness often depend on careful nursing and skilful administration of drugs, while surgical knowledge is indispensable when it is necessary to open deep-seated abscesses.

When the disease appears in lambs the advice of a veterinary surgeon should be sought as regards treatment of the affected animals, prevention of spread of the disease in the flock, and means to avoid unnecessarily soiling the farm.

If the smallness of the flock or distance from a veterinary surgeon renders veterinary advice out of the question, the following measures should be adopted:—

The affected lambs, with their mothers, should be isolated on a spot not likely to be used for sheep for some time. If only a few lambs are attacked it will be found cheaper to kill them and dry off the ewes, as only a small percentage of survivors grow into sheep which show a profit. If a large number are attacked, it is then worth while employing a man to nurse them who does not go near the healthy flock. The symptoms should be treated as they arise. Superficial abscesses should be opened with a sharp knife and then washed with a disinfectant. The evacuated matter should always be disinfected. The udders of the ewes should be carefully examined, for the lambs sometimes infect them. Bottle feeding will be necessary for the worst cases, and care must be taken that a lamb does not lie always on one side, as the limbs of that side are likely to waste or become paralysed.

WILLOW AND POPLAR LEAF BEETLES.

R. STEWART MACDOUGALL, M.A., D.Sc.

The insects named here belong to the family Chrysomelidæ, certain species of which claim the attention of the forester owing to the destructive work of the adults and larvæ on trees. Three genera are described below, viz., *Galerucella, Phyllodecta, and Melasoma.* Of the genus *Galerucella* there are seven species in Britain, two of which, *G. tenella* and *G. lineola,* feed on willow. The latter is the cause of great loss to osier plantations in England; it has also been sent to me, for determination, from Ireland as destructive on willow.

Of the genus *Phyllodecta* there are three British species, viz., *Phyllodecta vitellinæ,* destructive to willow and found also on poplar and alder; *P. vulgatissima,* destructive on willow and also found on poplar; and *P. cavifrons,* not so common as the others, and found on aspen and black poplar.

Of the *Melasoma* species, *M. populi* is found on young poplars and on willow, and *M. longicolle* on aspen and goat willow. A third *Melasoma* species, *M. æneum,* is found on alder; this alder species is readily known from the other two, as the upper surface of the body is all of the same colour, a golden green. *G. lineola, P. vitellinæ,* and *P. vulgatissima* are of distinct economic importance.

G. lineola is yellowish or yellow-brown in colour, while *P. vitellinæ* and *vulgatissima* have a metallic lustre, bronze or green or blue. In these three species the pupal stage is passed in the soil.

The two *Melasoma* species of poplar and willow have red wing-covers, and the pupa in their case is not found in the soil, but is attached to the under side of the leaf.

GALERUCELLA LINEOLA FABR.

This beetle has, in certain districts of England, from the year 1905 onwards, been reported as most destructive to osiers; in some cases hundreds of acres have been destroyed. The beetle has been specially destructive in Essex, Warwickshire, Gloucester, and Somerset. The attack has been an unfortunate one, not only from the loss to owners by destruction of their crop, but also from the throwing out of employment of workers connected directly or indirectly with willow cultivation. Some representative letters to the Board of Agriculture may be quoted:—"There are hundreds of acres here (Somerset) where the insects are playing havoc with the withy crops, stripping the leaves to an enormous extent." Again, and in a different year, from another district in Somerset:—"There are hundreds of acres of willows under cultivation, and the crop is being seriously injured by a beetle which settles on the young shoots when these come out, and eats off the bud and the young leaves as fast as they grow. The willows, instead of growing, as they ought to, 8 or 9 ft. long, are stunted and almost a failure; where this blight has affected them they only grow 2½ to 3 ft. long, and are rough and straggling instead of clean grown." "Crops that used to be worth £25 an acre now fetch no price at all." "The osiers on a sewage farm have been attacked by a blight which promises to ruin the crop" (Gloucester). "Out of a plot of 7 acres, something like 3 acres have been seriously damaged." "I rent an osier bed of 11 acres, and for the last three years the crop has been destroyed by this beetle" (Warwick). In July of last year, and again shortly after, adults and larvæ and destroyed foliage were sent to me from County Kildare.

The damage to the plants is done in different ways. The epidermis of the leaf is eaten away in patches; the lower epidermis and the mesophyll of the leaf are eaten, only the upper epidermis being left; the leaves are riddled with holes and are ragged at the edges where they have been gnawed by the adult beetles; the leaves are skeletonised; small pieces are bitten out of the delicate shoots of the year by the beetles.

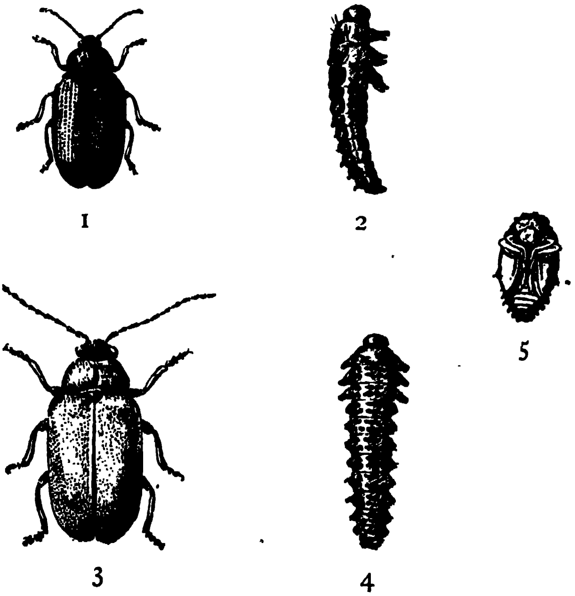
Owing to the destruction of leafage and the tops of the shoots, the rods have not a satisfactory length; there is a development of side shoots, and the crop may be rendered worthless.

G. lineola attacks *Salix triandra, S. purpurea, S. viminalis, S. caprea.* Some varieties suffer more than others; *e.g.* my Irish correspondent said that the leaves and bark of young Spanish willows (a variety of *triandra*) were being destroyed, while the green osier was left alone.

Description of Insect.—The Adult.—The beetle is oblong in shape, and measures 1/5 in. in length; there are slight variations in the size. The colour, on the upper surface, is yellow or yellow-brown. Fresh specimens show a covering of fine silky hairs. The apex of the joints of the antennæ, a spot on the thorax, the scutellum, are black. The thorax is narrower than the wing-covers, and shows a longitudinal middle line; on each side of the middle line is a depression. In some specimens the wing-covers may show black. The under side of the abdomen is black, but the tip is yellow-brown. The legs are yellow-brown.

Egg.—The egg is roundish, and orange-yellow in colour. Under a high magnification a distinct network pattern is seen. The eggs stand erect, in clusters.

Larva.—The head is small, round, and black. The general colour of the body where exposed is yellow or yellow-black. The segment next the head has a black or black-brown horny plate, each half of which shows depressions on it. On each side of the plate the yellow colour of the body is seen followed by a longitudinal dark-coloured tubercle; then the yellow of the body again, succeeded by dark dots above the leg. The next segment has eight dark plates on the upper surface, arranged in four pairs. At the very edge on each side is a comma-like tubercle, and then just above the leg are three dark dots in the form of a triangle. The tubercles carry hairs. The third segment resembles the second in plates and marking. A delicate line can be followed down the middle of the thorax. Each of these three segments of the thorax has a pair of legs. The first abdominal segment has two transverse plates in the middle of the back, with three dark dots on each side of these; lower down on each side is the dark spiracle. At the very edge of the segment is a projecting tubercle, bearing hairs. The abdominal segments which follow resemble the one just described, except the last segment, which is not only narrowed, but has a dark plate on its upper surface, and bears backwardly-projecting hairs. From this last segment a muscular process can be protruded; it is of service in locomotion, and is powerful enough to bear the weight of the body. The under surface is yellow or pale, with dark plates and dots. The full-grown grub measures about half an inch in length.



WILLOW BEETLES : all Figs. × 4.
1. *Phyllodecta vitellinæ.* 2. Larva of *P. vitellinæ.*
3. *Galerucella lineola.* 4. Larva of *G. lineola.* 5. Pupa of *G. lineola.*

Pupa.—The pupa is yellow. The shape is somewhat oval, and convex dorsally. There are bristles on the head and hind end, and in rows down the back.

Life History.—The adults that have appeared in summer and autumn pass the winter in crevices and under rubbish in the neighbourhood of the osier beds, under the rough bark of willows, and in hollow stems. In a piece (3 in. long) of a herbaceous stem, the pith of which had disappeared, I found in mid-February 50 adult *G. lineola* crowded together in winter hiding.

The beetles issue from their winter quarters in spring, and pass to the osiers while the new shoots are small, and they eat leaves and

Willow Beetles:—Left, egg cluster of *Galerucella lineola*; right, leaf skeletonised by larvæ of the same beetle.

bark. The females lay their eggs in clusters on the under sides of the leaves. I have in experiment found the eggs laid on the upper surface of the leaf and on the very young shoot of the year, but these were exceptional cases, due, I believe, to lack of space for egg-laying. A varying number of eggs is found in the cluster. In experiments I had every number from 5 to 21. Average numbers were 14 to 16. The time the egg takes to hatch varies with the conditions. In favourable environment hatching takes place in just over a week. In actual experiment in the laboratory 9 days was the shortest period, and 24 days the longest. The larvæ on hatching gnaw away the leaf from the under surface, often spoiling the new side shoots as the adults spoiled the terminal ones. It has been observed, too, that there is a tendency for the *lineola* grubs to begin with the leaves at the top of the shoot and eat downwards to the lower leaves, in contradistinction to the *Phyllodecta* larvæ, which begin lower down and eat upwards. The length of the larval life varies. In my experiments the shortest time was 27 or 28 days, and the longest 36 days. In the 28 days there is included a week during which the larvae had ceased feeding, and were lying in the soil previous to pupation. The full-grown larva leaves the plant and passes into the soil, where it pupates. The pupal state lasts 9 or 10 days. The length of the life cycle from egg-laying till the appearance of the first new beetles varies. Taking the shortest periods from the experimental records, such a cycle would be complete in 45 days, thus: Egg, 9 days; larva, 27 days; pupa, 9 days. Taking the longest periods for the different stages, we have 70 days, thus: Egg, 24 days; larva, 36 days; pupa, 10 days.

As to when the insect can be found in its various stages of development, the adult beetle can be found in any month of the year. Apart from hibernation, I have had adults in the open from May onwards to the very end of August. I have had eggs from May to the beginning of August; larvæ from the beginning of June (they will be found in May also), on through July up to August 13; and pupæ from July on to about the middle of August. Thus *G. lineola* may be found in all stages of development at the same moment.

OTHER BRITISH SPECIES OF GALERUCELLA.

G. tenella, a smaller species, is also found on osier. Till now I have no record of it as a pest on osier. It has been recorded from several Rosaceous plants. There is a record of it in Miss Ormerod's 16th Report on Injurious Insects, 1893, as destructive to strawberry plants in Hampshire.

G. viburni.—This beetle is in appearance like *G. lineola*, but it may be rather longer; it has a longer head, and its wing-covers are rather broader. It feeds on plants of the order *Caprifoliaceæ.* Fowler gives the Guelder rose and the Wayfaring tree as food plants. In August, 1910, it was sent to the Board of Agriculture from Sussex as destructive to leaves and young shoots of *Laurestinus.*

PHLLYODECTA (PHRATORA) VITELLINÆ L.

Adult.—The beetle is oval, and measures 1/6 to 1/5 in. in length. It is metallic bronze-green, or brassy; more rarely blue. There are regular lines of punctures on the wing-covers. The tibiæ or shanks are of the colour of the body.

Egg.—Large and shaped like a grain of wheat. The eggs lie on their sides in a double row, and in contact by their apices.

Larva.—The grub is dull white in colour. The head is black, as is also a horny plate or shield on the first segment behind the head. There are rows of black warts or tubercles down the upper surface of the body, and lateral tubercles with projecting hairs. On the under surface the segments show black markings. The length of the full-grown grub is over ¼ in. The larva has six legs.

PHYLLODECTA VULGATISSIMA L.

Adult.—This is a slightly smaller beetle than *vitellinæ*; it is narrower too, with the sides more nearly parallel. The colour is glossy metallic blue or green-blue, sometimes violet, and black. The wing-covers have rows of punctures, but the outer ones are somewhat irregular. The tibiæ and the feet are dark coloured.

Egg.—The egg is elongated and yellow or grey-yellow. The eggs are in clusters.

Larva.—The larva resembles that of *vitellinæ*, but the upper surface with its plates is darker; the under surface, however, is lighter, and lacks the dark patterns found in *vitellinæ*; the sides of the body are lighter, and have tubercles with light-coloured hairs.

PHYLLODECTA CAVIFRONS.

This beetle is about the size of *vulgatissima*, but has a more rounded body, and the punctures on the wing-covers are not confused but regular. Fowler writes that it can be distinguished from *vitellinæ* by "the deep-blue colour, excavated forehead, longer and stouter antennæ, longer and less transverse thorax." I have no record of this beetle as injurious.

LIFE HISTORY OF *P. vitellinæ* AND *P. vulgatissima*.

The insects pass the winter as adults in shelter places in the neighbourhood of the plants on which they feed and breed. They shelter not only in the soil and soil litter, but also above the soil in hollows in stems, in curled-up leaves, between buds that are arranged in whorls, under bark, and in the tunnels of bark-boring beetles, *e.g.* Altum records his finding numbers of *vitellinæ* making use of old ash trees that had been bored by *Hylesinus crenatus*, the Large or Black Ash Bark Beetle.

In the warm days of spring the beetles come out from their winter quarters, and go on to the shoots and willow rods as these are coming into leaf. Sometimes the beetles are in overwhelming numbers, and what is not destroyed by them is consumed by their larvæ. The female beetles lay their eggs on the under sides of the leaves in rows and clusters, and the grubs on hatching feed socially in rows. When the grubs are full grown they pass into the soil for pupation. The perfect beetles can be found at work from April onwards to the autumn, the new beetles from the grubs of the year appearing in August and passing to fresh material. Damage is done in various ways. The beetles bite pieces out of the bark of young shoots and gnaw the upper parts of the willow rods, which die off in consequence; they also skeletonise the leaves. The larvæ feed on the leaves, eating away the lower epidermis and the soft tissue of the leaf.

References in the literature attest the trouble and loss caused by these two species of *Phyllodecta*. *P. vitellinæ* is mentioned by Theobald, Warburton, and Collinge, and *P. vulgatissima* was reported by Carpenter as damaging osiers near Lurgan. From Leicestershire, specimens of *P. vitellinæ* were sent to the Board of Agriculture with a statement that 84 acres of willows were more or less infected. The beetles were sent in May, and they were busy laying their eggs. In May of last year complaints were sent to the Board from South Devon concerning *P. vulgatissima*, half of a good bed of young willows having been destroyed by this species. "They settle on the leaves of the young plant, and eat them away, which has the effect of stunting the growth to an alarming extent. Some years ago there was a similar visitation, but the starlings came and devoured the beetles."

THE RED POPLAR LEAF BEETLE (*Melasoma populi L.*).

Adult.—The beetle measures between ⅜ and ½ an inch in length. In shape it is oval and convex. The antennæ are short, and are thickened towards the apex. The thorax is blackish or greenish-blue, is considerably narrower than the wing-covers, and is punctured. The wing-covers are arched, and are somewhat wider towards the hind end; in colour the wing-covers are brick-red, tipped with black where they meet at the hind end.

Egg.—The egg is yellowish and longish oval.

Larva.—The larva is dirty white or dirty green-white in colour, with black head and legs, and a number of black spots down the body. On the upper surface of the first joint behind the head is a horny shield and two black warts; the next two joints have on their upper surface four black warts, and on the sides are white processes; the abdominal segments show rows of dorsal and lateral tubercles, from which glands can be protruded; the glands give out a fluid when the grub is disturbed. On the under surface of the abdominal rings are rows of black spots. The legs are six in number. The body is somewhat arched, and is narrower at the two ends.

Pupa.—The pupa is ovate or pear-shaped, and is brown-yellow in colour, speckled with regularly arranged black spots. It hangs head downwards from a leaf attached by the narrowed hind end.

In July, 1909, a correspondent of the Board reported that the larvæ were at work on white poplar trees, but by the end of July nearly all the larvæ had disappeared.

MELASOMA LONGICOLLE SUFFR.

In the Continental forest literature two further poplar and willow species are given, viz., *M. tremulæ,* Fabr. and Suffr. (*Saliceti,* Weise) and *M. longicolle,* Suffr. (*tremulæ,* Weise), the differences given being very slight. In Britain, Fowler names only *M. longicolle,* Suffr. *M. longicolle* greatly resembles *M. populi,* but is smaller and narrower. There is the same contrast between the dark colour of the thorax and the red of the wing-covers. The wing-covers in *longicolle* are red all over; there are no black tips to them as in *populi.*

Life History.—The life histories of the *Melasoma* species resemble one another. Winter is passed in the adult stage, the beetles appearing in the next season with the leaves. The females lay their eggs in clusters on the under sides of the leaves; the eggs are fixed in the erect position. The eggs soon hatch, and the grubs feed on the leaves. The full-grown larva attaches itself by the narrow hind end to the under surface of a leaf, and moults its last skin, and the pupa becomes visible; the moulted skin is wriggled backwards. The pupa hangs down like a bell or a pear.

(Preventive and remedial measures will be discussed in a subsequent issue of the *Journal.*)

THE PRESENCE OF TUBERS ON POTATO HAULMS.

GEORGE MASSEE, F.L.S.

The occurrence of tubers in the axils of leaves of the above-ground portions of potato haulms has been known for a long time. Knight figured and described small tubers in the axils of the sepals of a potato, in *Proc. Hort. Soc.*, 1, p. 39, Fig. 2 (1844). Vöchting has given the most detailed account of the origin of tubers, and of the various causes influencing their development on unusual portions of the plant; his observations, however, were mainly conducted from a physiological standpoint (*Bibliotheca Botanica,* Heft 4, 1887). Sorauer, in his *Handb. der Pflanzenkrankheiten,* p. 163 (1909), has some remarks on the subject, and amongst other causes accounting for the formation of tubers on the aerial portions of the potato, he instances drought, and injuries caused by animals.

Experiments conducted in the Jodrell Laboratory, Kew, and at the experimental ground for observations on the growth of potatoes connected with Kew, have demonstrated that the formation of tubers on above-ground parts of a potato plant may be directly due to more than one specific cause.

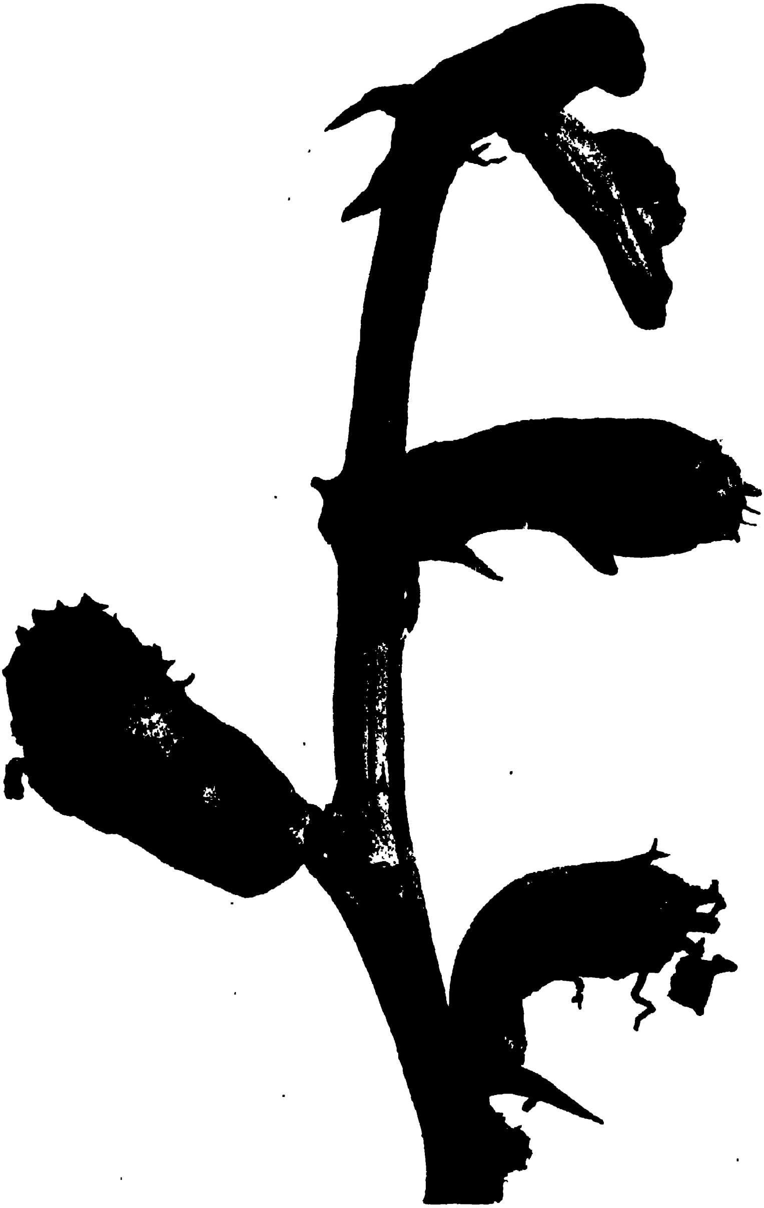
The underground, tuber-producing branches suffer much sooner from drought than do the roots; hence all the underground branches destined to produce tubers may be killed, while the remainder of the plant continues to grow vigorously. In such circumstances, tubers are frequently produced in the axils of the leaves, on the above-ground portion of the haulm. This is more especially the case when a more or less prolonged drought occurs soon after the plants appear above ground, and is followed by an excess of rainy weather. Such conditions have prevailed in many districts during the present season, and the occurrence of tubers on the haulm has been much more frequent than usual.

In addition to the influence exercised by weather conditions on the formation of tubers on the haulm of the potato plant, it has been observed that parasitic fungi, present in the "seed," are also potent factors in favouring this abnormal development. Amongst such, winter-rot, caused by *Nectria solani*, Reinke and Berthold, plays a prominent part. In the experimental ground, where "seed" known to be infected with winter-rot has been planted, examples of above-ground tubers, produced on the haulm, have been constantly present. Microscopic examination of the "seed" has invariably revealed the presence of the very delicate mycelium of the fungus producing winter-rot, and it is not difficult to trace this mycelium in the tuber-producing underground branches, where it rapidly increases to such an extent that the branches are killed, and the production of underground, normal tubers consequently prevented. In such cases, as a rule, the roots are not attacked by the mycelium, hence the plant continues to grow, but fails to produce a crop of tubers. At this stage one of two things may happen, depending on circumstances. If the mycelium of the winter-rot fungus does not extend to any great extent in the vegetative portions of the potato plant, the roots and the haulm, the plant may produce a fairly vigorous "top," with a few underground tubers about the size of marbles. On the other hand, if the mycelium of the fungus extends to the base of the above-ground branches, the growth becomes stunted, the leaves remain small, and soon commence to curl, resulting in one form of the disease known as "leaf-curl." In such circumstances, the formation of tubers on the aerial portions of the potato has not been observed.

Judging from experiments with "sets" infected with winter-rot, conducted at Kew, and from the numerous consignments submitted to Kew for investigation, it would appear that a very large percentage of the cases coming under the category of "leaf-curl" are primarily due to the "sets" having been infected with winter-rot when planted. The symptoms are a general dwarfing of the above-ground parts, with leaves small, soon becoming speckled with yellow, and curling towards the upper surface, and the tubers few and small, or altogether absent. In extreme cases the haulm is killed before it appears above-ground. It is by no means an easy matter to distinguish tubers that are only slightly infected with winter-rot, for so long as they are kept dry and free from sweating the mycelium remains in a quiescent condition, and only commences active growth when favoured by physiological changes in the tuber preliminary to growth. When tubers that are only slightly infected with winter-rot are stored before they are thoroughly dry, the mycelium continues to grow, and before the following spring such tubers are usually reduced to a soft, strong-smelling, loathsome mass, sometimes known as "soft-rot."

On the other hand, when a tuber slightly infected with winter-rot is planted, the tuber is but slightly, if at all, altered in appearance, and most frequently remains apparently unchanged and quite hard, the mycelium passing from the tuber into the young growth. Wherever the symptoms of leaf-curl, as defined above, accompanied by an absence of crop, and with the "set" remaining hard and apparently unchanged, occur, the cause may safely be attributed to a "set" infected with the mycelium of the fungus causing winter-rot having been planted. When the matter comes to be thoroughly investigated, it will probably be shown that winter-rot, in its winter and summer phases respectively, is responsible for greater loss than all other potato diseases collectively.

Pot cultures are very instructive in demonstrating the much greater susceptibility of tuber-producing branches than roots, in regard to drought. Similar cultures are equally useful in indicating the preference shown by the mycelium for the tuber-bearing underground branches, rather than for the roots, the explanation in this case being the greater supply of food to the former. Treating tubers infected with the mycelium of winter-rot fungus with formalin has not resulted in the eradication of the disease. Such result was scarcely to be expected, taking into consideration the fact that the mycelium frequently permeates the entire substance of the tuber. The periderm of the tuber is antagonistic to this method of treatment, and the paring of tubers before treatment is impracticable. Furthermore, no evidence is forthcoming to show that the



Tubers on Above-ground Portion of Potato Haulm.

protoplasm of the potato is more resistant to the action of formalin than the protoplasm of the fungus, which should be the case to secure the result desired. The same remarks apply to the mycelium of *Phytophthora infestans,* De Bary, when present in the flesh of a tuber.

The tubers produced in the axils of leaves above-ground are constantly sessile, and rarely exceed an inch in length, but in a very fine example sent to Kew during the present season, the largest tuber was two and a half inches long. The accompanying figure, reduced by one-third, illustrates this specimen.

Physiological Effects of Rations drawn from Restricted Sources.

In an article on the Conference of Agricultural Teachers at Cambridge, which appeared in the issue of this *Journal* for August, 1912, p. 360, some account was given of a paper by Dr. F. G. Hopkins, dealing with modern views on the subject of nutrition. In this paper it was suggested that recent work tends to bring into prominence what may be termed the specificity of a ration, and to show that a knowledge of the amount of digestible albuminoids and of the energy value or starch equivalent of a ration affords only very incomplete information as to its actual feeding value. The subject came up again at the recent meeting of the British Association, and was very fully debated. In this connection attention may be directed to a recent bulletin published by the University of Wisconsin,* giving an account of an investigation of the comparative effects of four sets of rations, all of the same energy value, and of approximately the same albuminoid ratio, but made up of different descriptions of food. Sixteen heifer calves were taken, and divided into four lots of as nearly equal total weights as possible. For three groups the rations were limited to the products of a single species of plant. Lot I. received a feed composed entirely of the products of the maize plant; Lot II. received all its nutrients from the wheat plant—wheat meal, wheat gluten, and wheat straw; Lot III. was fed entirely on the products of the oat plant; and Lot IV. was given a mixed ration of equal parts of maize, wheat, and oat products. In all four cases the proportion of digestible nutrients (albuminoids, carbohydrates, and fat) was as nearly as possible the same, and the albuminoid ratio approximately 1 : 8. These rations were given for two years; subsequently they were readjusted so as to give equal energy values, and the experiment was continued for two years more, or four in all. Observations were taken of a very large number of external and physiological phenomena, including rate of growth, amount of food consumed, digestibility of foods, periods of "heat," size and vigour of offspring, character of the milk produced, and other matters of a more recondite nature.

---

* *The University of Wisconsin Agricultural Experiment Station* (Research Bull. No. 17): "Physiological Effect on Growth and Reproduction of Rations Balanced from Restricted Sources."

Some of the results are most remarkable, particularly one which establishes the fact that a diet composed entirely of the products of the wheat plant is extremely deleterious, not only to the animal itself, but more markedly so to the offspring. It is also surprising to learn that the animals fed on maize and its products did best of all, the order of merit being maize, oats, mixed diet, wheat. The bad effects of maize grain when used as the sole food of pigs are well known; either these effects do not occur with cattle, or the addition of maize straw more than neutralised them. The rates of growth of all four lots were very similar, the differences being confined to vigour, resistance, and general metabolism. The maize-fed animals looked smooth of coat, and fuller through the barrel than the others. The wheat-fed animals had staring coats and a gaunt appearance. The reproductive functions of the latter were in some respects abnormal; they dropped their calves from two to five weeks before full time; the calves averaged only 46 lb. at birth against the 73 lb. of those from the maize-fed mothers, and a large proportion of them died within a few days. It was noticed that the ill-health of the wheat-fed cows was associated with abnormal acidity of the urine.

These results were not accidental, for on changing the maize-fed animals to a wheat diet, and *vice versâ*, the effects associated with the diets immediately made their appearance.

The authors summarise these results in the following words:—"There is evidence from the data that there is a distinct and important physiological value to a ration not measurable by present chemical methods, or dependent on a mere supply of chemical energy. While the latter are important and give valuable data for a starting point, they are, nevertheless, inadequate as final criteria of the nutritive value of a food."

Production of Lambs in Autumn and Winter.

As a general rule, conception in a ewe is not possible until autumn, with the result that the lambs are dropped in the following spring. In response, however, to a demand for meats of an unusual nature in several of the large towns of the United States, an attempt has been made to supply lambs weighing 30–40 lb. dressed weight from December to May. The production of these early or "hothouse" lambs forms the subject of a bulletin issued by the Cornell University.*

Management of the Flock.—The management of the flock is as follows:—In the spring, after the lambs are taken away, the ewes are put on a ration of hay alone for two or three weeks, and their udders carefully watched to see that no trouble arises from caked udder. In some cases it is necessary to milk out the ewe once a day, and later once every third day, until she is dry. The ewes are then given a few roots to keep them in good condition until they are turned out to pasture for the summer.

The pasture season at the College ordinarily commences about May 15th. The flock of ewes has been made up from several breeds, and ordinarily three pure-bred rams, a Hampshire, a Southdown, and a Dorset Horn, have been turned out to pasture with the flock. No particular method of getting the ewes to breed early is followed—they are simply allowed to breed at will. Care, however, is taken to see that they are in as good a condition as possible when turned out, and that the rams are young and active. Three rams are employed, for the reason that competition among the rams tends to activity. The ewes have access to plenty of water, and receive plenty of salt. Late in the grazing season the pasture is supplemented with green foods. The object aimed at is to put the ewes in a condition to give as much milk as possible for the use of the lamb.

---

* *Cornell Univ. Agric. Exp. Station*, Bull. 309: "Production of Hothouse Lambs."

After the flock is taken from pasture, the rams are separated until the next pasture season. They are kept in good condition, but otherwise receive no particular care. The ewes, until lambing, are fed on clover hay alone, grain being added, however, if they are out of condition. Each pen contains from ten to fifteen ewes, and sufficient bedding is provided in the pens to keep them dry at all times, and they are protected so that the temperature rarely falls below 40° F. No artificial heat is employed, though it is thought that it might be better to provide an artificially-warmed lambing pen, to prevent chilling the new-born lambs. The lambs are dropped in the ordinary pens, and the ewes and lambs are removed to other pens, about eight to ten ewes with their lambs being placed in one pen of the size of about 10 ft. by 15 ft. The ewes are now fed on hay, grain, and roots; the grain is fed lightly at first, and afterwards increased to 2–3 lb. per head per day; roots generally take the form of 2 lb. turnips per head per day.

The lamb at first, of course, is fed entirely on the ewe's milk. This is supplemented by grain as the lamb grows, a separate place for eating being provided into which the ewe cannot pass. The grain is always kept before the lambs, and they soon learn to like it; care, of course, is taken that it is not fouled in any way. The lambs usually grow rapidly enough to be ready for slaughter in from 70 to 75 days from birth. The slaughter weight in these experiments was about 45 lb. to 48 lb., so that the lambs gained about ½ lb. per day.

In eight years, 84 ewes have produced "hothouse" lambs. The average length of time that each ewe was in the flock was 3·88 years. The 84 ewes produced a total of 401 lambs, of which 261 were sold as "hothouse" lambs at an average price of £1 11*s*. 4*d*. Of these, 60 were sold before March 4th at an average price in the eight years of £2 1*s*. 8*d*. per carcass (of about 35 lb.). The average number of "hothouse" lambs from each ewe was 3·1, *i.e.*, practically one per annum. There were, of course, in addition, other lambs born later, which had to be used in the ordinary way. The average yearly income per sheep over the whole experiment was £1 5*s*., excluding the value of the wool sold. The earliest breeding ewes were (in order of early breeding) Dorset, Rambouillet, Delaine, Cheviot, and Shropshire.

Production of Timber in Great Britain.

The Report of the Board of Agriculture and Fisheries, on inquiries made in connection with the Census of Production Act, 1906, contains information as to the area under woodland, and production of timber in Great Britain in 1908. A special return of the area of woodland was obtained in 1905; and the inquiry of 1908 was directed, in the first instance, to ascertain what changes in area had occurred since that date. The schedules were as far as possible sent to the same persons as those by whom the returns in 1905 were made, the figures then returned by them being entered on the schedule with the request that they would supply the corresponding figures as at June 4th, 1908. The total area under all woodland, and the area returned as plantations, *i.e.*, land planted within the preceding ten years, are shown in the following table for both years:—

	ALL WOODLANDS.		PLANTATIONS.	
	1908.	1905.	1908.	1905.
	acres.	acres.	acres.	acres.
England	1,720,330	1,715,473	72,008	59,647
Wales	186,723	184,361	11,355	8,629
Scotland	874,910	868,409	44,146	35,407
Great Britain	2,781,963	2,768,243	127,509	103,683

There were thus 2,782,000 acres of woodland in Great Britain in 1908, of which 128,000 acres were described as plantation. This represents an increase of 24,000 acres of plantation, the net increase in the total area of woodland in the three years being 14,000 acres.

The schedule also asked for particulars of the acreage of pure woods, distinguishing the kind of tree in each case, and of mixed woods whether of all coniferous, all broad-leaved, or of both together. The schedule further asked for the number, quantity in cubic feet, and value of trees felled or sold standing during twelve months, classified under the different headings. The acreage under the principal kinds of trees in England and Wales, Scotland and Great Britain respectively, was as follows:—

Kinds.	England and Wales.	Scotland.	Great Britain
Coniferous Woods—	acres.	acres.	acres.
Scotch Pine	49,000	156,000	205,000
Larch...	69,000	25,000	94,000
Spruce	1,000	8,000	9,000
Others and Mixed	135,000	293,000	428,000
Total	254,000	482,000	736,000
Broad-leaved Woods—			
Oak	130,000	9,000	139,000
Beech...	25,000	1,000	26,000
Birch	1,000	10,000	11,000
Others and Mixed	476,000	75,000	551,000
Total	632,000	95,000	727,000
Mixed Coniferous and Broad-leaved Woods	1,021,000	298,000	1,319,000
Total Acreage of Woodland ...	1,907,000	875,000	2,782,000

The estimated production of timber in the twelve months ending June, 1908, distinguishing the principal kinds, is shown in the following table:—

Crop.	Trees felled for sale, or sold standing.		
	Number.	Quantity.	Value.
		Cubic feet.	£
Larch	560,000	3,709,000	144,000
Scotch Pine	441,000	3,895,000	81,000
Spruce and Other Coniferous trees ...	77,000	587,000	12,000
Oak	219,000	3,604,000	237,000
Beech	89,000	1,349,000	51,000
Ash	41,000	598,000	37,000
Elm	15,000	583,000	21,000
Birch, Sycamore, Chestnut, and Other Broad-leaved trees	66,000	520,000	15,000
Total	1,508,000	14,845,000	598,000

The value of other wood sold or used at home, *e.g.*, pit props, small thinnings, cord wood, faggots, bavins, &c., and the value of osiers sold, together make the total value of timber of all kinds sold or utilised during the year about £800,000.

The Development of Agricultural Co-operation in Great Britain.

A report * recently issued by the Board of Trade on co-operative societies in the United Kingdom contains information on the development and present condition of agricultural co-operation in Great Britain. The following particulars are given in the report with regard to the condition of the societies in 1909, the figures for 1895 (or later years where no particulars are available for this year) being added for comparison.

Co-operative Agricultural Distributive Societies.—These societies undertake the collective purchase of the manures, seeds, implements, etc., required by the members and the collective sale of their produce. There were 145 such societies at work in 1909 in England and Wales, and 31 in Scotland as compared with 4 and 1 respectively in 1895. In England and Wales in 1909 the membership was 13,589, the total sales were £885,683, and the profit £8,140; while in Scotland in the same year the membership was 3,860, the sales £227,141, and the profit £1,948.

With regard to egg and poultry societies there were at the end of 1909 15 such societies in England and Wales, with a membership of 986 and total sales amounting to £15,453, while in Scotland there were two such societies with a membership of 89 and total sales amounting to £438.

Co-operative Productive Societies.—These societies are occupied in buying, manufacturing, and selling the produce of the individual members, and their operations are chiefly confined to the dairying industry. In 1909 there were 18 such societies in England and Wales with a membership of 1,048, a share capital of £20,356, total sales amounting to £66,506 and a profit of £640, as compared with 7 societies in

---

* Report on Industrial and Agricultural Co-operative Societies in the United Kingdom, 1912 [Cd. 6045]. 1*s.* 8*d.* Wyman & Sons.

1895 with a membership of 665, share capital of £13,597, total sales amounting to £17,544 and a loss of £120. In the case of Scotland 5 societies were at work in 1909 against 1 in 1895, and the sales had increased from £11,786 in 1895 to £37,317 in 1909. There was a loss on the working of these Scottish societies in both years.

Agricultural Insurance Societies.—An important position among these societies is held by the cattle and pig insurance societies. Their number and work have, however, increased only very slightly, *viz.*, from 55 with a membership of 3,424 and reserve funds of £6,509 in 1899, to 57 societies with a membership of 3,954 and reserve funds of £7,671 in 1909 in the United Kingdom.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Manuring of Meadow Hay (*Agricultural Students' Gazette, Roy. Agric. College, Cirencester, August,* 1912, Mr. E. Kinch and Mr. R. G. Stapledon).—Experiments were continued in 1911–12 on the plots used for the past twenty-one years, the manures applied being of the same kind and amount as in previous years. A detailed botanical analysis of the herbage on the different plots has been made, and the effects of manuring, depth of soil, and content of lime on the general character of the crop and on individual species, are discussed. The results show that—(1) On the variable soils of the Cotswolds very marked differences occur in the composition of the herbage as the result of variations in the depth of soil and in the percentage of lime. (2) These differences may be as great or greater than those produced by manurial treatment. (3) The actions of the manures on the deeper and shallower soils are very different, particularly as regards their influence on the composition of the herbage. (4) On the Cirencester soil, which is rich in lime, sulphate of ammonia and nitrate of soda give very similar results, and sulphate of ammonia does not spoil the meadow in the way common on soils containing less lime, as, *e.g.*, at Rothamsted. Farmyard manure, rape meal, and guano have improved the quality of the herbage. (5) For the Cirencester district it would seem that superphosphate is generally the best phosphatic manure for grass land. Basic slag is, however, useful on exceptional fields where lime is deficient and the moisture is well retained. Where Upright Brome grass is very plentiful (generally on thin chalky soils) the field should be set apart for hay every year, and the growth of the grass encouraged by a complete mixture of artificial manure; lime and potash particularly seem to favour it. Where buttercups are very plentiful, manuring for a few years with sulphate of ammonia will greatly reduce them.

---

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Manuring of Meadow Hay (*Northumberland Co. Agric. Expt. Sta., Cockle Park, Guide to Expts.*, 1912).—A comprehensive series of plots was laid down in 1897 on stiff Boulder Clay Soil. The plan of the experiment and the average results for the fifteen years 1897 to 1911 are given in the following table:—

Plot.	MANURES PER ACRE. (Applied every year, unless otherwise stated.)	Average Annual Cost of Manure per acre.†	Average Crop per acre in the 15 years.
		£ s. d.	Cwt.
1	8 tons Dung and artificials *	2 15 11	40¾
2	8 ,, Dung	2 0 0	37½
3	8 ,, Dung in alternate years; artificials * in other years...	1 8 0	33½
4	8 ,, Dung in alternate years	1 0 0	30¼
5	16 ,, Dung every fourth year; artificials * in other years...	1 11 11	34¼
6	No Manure	—	19
7	150 lb. Sulphate of Ammonia	0 17 8	24¼
8	300 ,, Basic Slag...	0 6 1	24¾
9	100 ,, Muriate of Potash	0 8 0	15¾
10	150 ,, Sulphate of Ammonia 300 ,, Basic Slag	1 3 9	30¼
11	150 ,, Sulphate of Ammonia 100 ,, Muriate of Potash	1 5 8	21¼
12	300 ,, Basic Slag 100 ,, Muriate of Potash	0 14 1	26
13	150 ,, Sulphate of Ammonia 300 ,, Basic Slag ... ... 100 ,, Muriate of Potash	1 11 9	30¼
14	75 ,, Sulphate of Ammonia 100 ,, Nitrate of Soda 300 ,, Basic Slag ... ... 100 ,, Muriate of Potash	1 11 10	31
15	As for Plot 14. but in alternate years only.	0 15 11	23¼
16	Half the dressing given to Plot 14 (same dressing of artificials as given to Plots 1, 3, and 5)...	0 15 11	22¾

37½ lb. Sulphate of Ammonia
50 ,, Nitrate of Soda
150 ,, Basic Slag
50 ,, Muriate of Potash
† Estimated cost of dung 5*s*. a ton.

The quality of the hay from some of the plots was compared in 1905–6 and 1907–8 by means of botanical and chemical analysis, and by feeding separately to different lots of sheep.

Manuring of Meadow Hay (*Yorks. Co. for Agric. Educ., and the Univ. of Leeds, Guide to Experiments*, 1912).—A series of plots designed to compare different systems of manuring meadow land was laid down at the Manor Farm, Garforth, in 1899, and the same plots have been treated on the original plan since then. The following table shows the plan of the experiments and the results up to 1910.

No. of Plot.	Manure per acre.	Cost of Artificials per acre in 1912.	Average Annual Crop per acre 1899–1910.
		£ s. d.	Cwt.
1	No Manure	—	29½
2	10 tons Dung every year	—	52½
3	10 tons Dung in alternate years	—	46
4	10 tons Dung in alternate years; in other years, 1½ cwt. Nitrate of Soda	0 16 4	50¼
5	10 tons Dung in alternate years; in other years { 1½ cwt. Nitrate of Soda 2 ,, Superphosphate }	1 1 1	49¾
6	10 tons Dung in alternate years; in other years { 1½ cwt. Nitrate of Soda 2 ,, Superphosphate 3 ,, Kainit }	1 8 9	52
7	1½ cwt. Nitrate of Soda 2 ,, Superphosphate 3 ,, Kainit } every year	1 8 9	42¾
8	*130 lb. Sulphate of Ammonia 2 cwt. Superphosphate 3 ,, Kainit } every year	1 9 5	38¼
9	1½ cwt. Nitrate of Soda 2 ,, Superphosphate } every year... ...	1 1 1	40½
10	*130 lb. Sulphate of Ammonia 2 cwt. Superphosphate } every year	1 1 9	35½
11	1½ cwt. Nitrate of Soda every year	0 16 4	36¼
12	*130 lb. Sulphate of Ammonia every year...	0 17 0	30½
13	No Manure	—	27¾

* Containing the same quantity of nitrogen as 1½ cwt. Nitrate of Soda.

In July, 1909, a botanical analysis was made of samples of the herbage taken at mowing time from certain of the plots. The herbage was dried under cover, and the following table gives the summarised percentage composition by weight.

Kind of Plant.	NUMBER OF PLOT.							
	1	2	3	6	7	9	11	12
	%	%	%	%	%	%	%	%
Good Grasses	17·8	43·3	60·2	62·7	69·6	50·6	45·4	17·0
Inferior Grasses	59·1	14·3	6·7	4·6	15·5	12·7	26·7	62·9
Leguminous Plants ...	—	—	0·1	—	0·3	—	0·01	—
Miscellaneous Weeds...	18·3	36·8	28·9	29·5	10·8	24·5	19·2	12·5
Undetermined	4·8	5·6	4·1	3·2	3·8	6·2	8·7	7·6

The chief "Good Grasses" were Cocksfoot, Golden Oat Grass, Meadow Foxtail, and Tall-Oat Grass. The "Inferior Grasses" were Common Bent, Soft Brome, Sweet Vernal, and Yorkshire Fog. Of the "weeds," Sorrel was the most abundant on all the plots, but Hogweed and Beaked Parsley were abundant on the plots receiving dung, particularly on Plot 2, which is given a dressing every year.

Some Bacteriological Effects of Liming (*Iowa Agric. Expt. Sta., Research Bull. No. 2*).—The effects of applications of ground limestone on crop yields, the total number of bacteria in the soil, and the number of bacteria of certain groups, were determined, and an attempt was made to correlate the three phenomena. The ground limestone was carefully mixed with different lots of soil in pots at the rates of one half, one, two, and three tons per acre, and the pots were kept at approximately uniform temperature and moisture content throughout the experiment. After the lapse of a month, the soils were sampled, the sampling being repeated three times at intervals of two or three weeks; at each sampling the number of bacteria was estimated. It was found that the applications of limestone had resulted in an increase in the number of bacteria in the soil, and the increase was almost proportional to the amount of limestone applied up to three tons per acre. In all cases the largest percentage of gain in bacteria was shown at the first sampling. At subsequent dates differences occurring in all the soils, both treated and untreated, obscured to a greater or less extent the differences due to liming.

The applications of limestone were also found to increase the ammonifying, nitrifying, and nitrogen-fixing powers of the soil, the increases in each case being found to be almost proportional to the weight of limestone given. In the case of crop yields the smaller dressings had little effect, but with the two ton and three ton applications the crop was materially increased. The nitrogen content of the crop was increased to a much greater extent than the weight of the crop itself.

The Fertilising Action of Sulphur (*Jour. d'Agric. Prat.*, September 5th, 1912).—Previous experiments in France had shown that flowers of sulphur added in very small quantities to soil in pots caused a notable increase in the yield of the plants, and that the action of the sulphur was very weak when the soil had been previously sterilised.

The present experiments showed the fertilising action of the flowers of sulphur to be due to its stimulating effect on the bacteria which convert organic nitrogen compounds into ammonia, and also on the nitrifying organisms of the soil.

FIELD CROPS.

Varieties of Wheat (*East Suffolk County Education Committee Report*, 1912).—A test of several varieties of wheat was carried out in East Suffolk in the season 1911–1912 at three centres. The results at the different centres agreed very well, and the following are the average yields in bushels of total grain per acre:—Wilhelmina 46¼, Victor 44¼, Square Head's Master 42, Standard Red 41½, Little Joss 40½, Selected Square Head 39¼, Svalof Original Grenadier II. 38, and Essex Conqueror 37¾. Golden Drop and Stand-up White (Wilson's selected) were each tried at only one centre, and gave respectively 42 and 41¼ bushels of grain per acre. The following notes were made on the general appearance of the wheats:—

Wilhelmina.—White wheat, white chaff, good heads, fairly short straw. Seems to produce a large proportion of small corn.

Victor.—Very similar to Wilhelmina.

Standard Red.—Very similar to Square Head's Master; a rather long straw.

Little Joss.—Possesses very great powers of tillering; yield surprising in view of size of ears; straw rather apt to lie down. No opportunity was afforded of observing whether it was immune to rust, as there was very little on any variety.

Svalof Original Grenadier II.—Red wheat, white chaff, short straw.

Essex Conqueror.—Red wheat, white chaff, open ears, long straw.

Samples of the different varieties were examined by a local miller, who classified them, from a miller's point of view, as follows: 1st Class, Little Joss. 2nd Class, Standard Red, Square Head's Master, Essex Conqueror, Golden Drop. 3rd Class, Selected Square Head, Stand-up White. 4th Class, Wilhelmina, Victor, Red Admiral. 5th Class, Svalof Original Grenadier II.

Competition in Cereals (*Univ. of Nebraska, Agric. Expt. Sta., Bull. No.* 127).—Experiments have been carried on for some years with winter wheat and oats to secure information as to the extent to which mutual competition eliminates plants under various rates of seeding, and also to determine the effects of placing plants from undeveloped or small seeds in competition with others from large, well-developed seeds. Seeds were sown at various distances, from ¼ in. to 2 in. apart. To test the effect of competition between plants from large and small seeds, bearded and beardless wheats, and black and white oats were used to enable the two lots of plants to be distinguished when sown in a mixture. It was found that there was considerable mortality among the seedlings, and that in all cases the percentage loss was considerably greater with the thick seeding. When large plump seed was sown along with poorly developed seed, a smaller proportion of plants from the latter survived to harvest than when the poorer seed was sown alone.

Other experiments have shown that a considerable variation in the rate of seeding of winter wheat may be made without seriously affecting the yield. This appears to be due to the ability of the plant to adjust itself to the conditions. In both wheat and oats with thin and thick seeding the number of plants per unit area varied from about 40 or 50 to upwards of 250, and still the actual yield per plot varied very little.

The Hereditary Characters in the Potato (*Jour. Roy. Hort. Soc., July,* 1912, Dr. R. Salaman).—For the past five years, work has been carried out on Mendelian lines with a view to the analysis of the factors which underlie and determine the varying characteristics of the potato plant. The analysis has not been conducted primarily with an economic outlook, but facts which have an important practical bearing have been discovered. The characters thus far isolated are as follows:—

The Flower.—The potato flower may be either white, heliotrope, or purple in colour, and five pairs of factors influencing flower colour have been determined. There appears to be no relation between any of these and the quality or shape of the potato.

Sterility of Anthers.—The sterility of anthers has been shown to be dominant. No connection between this character and any economic quality has been found.

Shape of Berry.—The berries of domestic varieties are round, while those of wild types, such as *S. etuberosum, S. verrucosum, S. commersoni*, are long. The length of berry is due to a single pair of factors. Individuals which are hybrid as regards length have heart-shaped berries. Round-berried plants breed true as regards shape of fruit.

The Haulm.—The one hereditary character of the haulm which is clearly controlled by a single pair of factors is that of the habit of growth—upright or prone. Most, if not all, cultivated varieties of potatoes grow upright during the greater part of the season, but when they begin to die down, noticeable differences occur. The haulm of some varieties stands bolt upright even when dead. Others, when maturing, tend to become *bushy*, and the lower branches, if not the whole haulm, come to lie down on the ground. Seedlings have, however, been raised which lie flat on the ground all through the growing period. The upright and prone plants breed true to character of growth, but the bushy plants are heterozygous, and split up when self-fertilised into upright, bushy, and prone, in the proportion of 1 : 2 : 1.

Stolons.—The underground stems which carry the tuber are of varied lengths. In certain wild species, such as *S. commersonii* and *S. verrucosum*, they may attain some six feet or more. In the domestic varieties they are not usually more than nine inches or a foot long, and may be much less. Closely related to the question of stolon length is the disposition of the tubers with regard to the central axis of the stem. In some varieties the tubers are close up to the main stalk, in others they are found some distance away from it. Generally speaking, the heaviest cropping varieties have the tubers close up to the central stem.

Tuber.—The *shape* of tuber is controlled by several pairs of factors, and possibly in addition to those already determined there are others. The *depth of "eye"* is controlled by a single pair of factors. The *colour of skin* may be either white, red, or black (*i.e.*, deep purple). The red skin is due to at least two distinct factors, the absence of either of which renders the tuber white, while the purple is due to the presence of a third factor. Red- and purple-coated tubers are often similarly pigmented in the flesh, but this pigmentation can be shown to be due to a single pair of factors, and it is possible to produce a dark-coated tuber with white flesh, or a white-fleshed variety which, when mated with any coloured variety, will cause all its coloured-skinned offspring to have coloured flesh.

Resistance to Attacks of Disease (Phytophthora infestans).—In 1909 and 1910, when disease was exceptionally prevalent, one-fourth of the seedlings of *S. etuberosum* were unaffected by disease, while the remainder perished. From these immune individuals numerous crosses have been made and large families formed. It is hoped that in the second-generation families the recessive quality of immunity may segregate out. It is conceivable that a really immune potato to which other desirable qualities may readily be added is not an improbable feature of the future.

Sprouting Seed Potatoes (*Jour. Dept. of Agric. and Techn. Instr. for Ireland*, April, 1912).—Experiments were carried out at three hundred and twenty-two centres in Ireland in 1911 to test the effect of sprouting seed potatoes before planting. Taking the average results for the different counties, the increase in yield per acre due to sprouting varied from 12 cwt. in Co. Dublin to 2 tons 19 cwt. in Co. Carlow. The average results of similar tests carried out in the last nine years are given, and show that in about a thousand tests the average increase in yield due to sprouting was 2 tons per acre.

Experiments with Lucerne (*Univ. of Missouri Agric. Expt. Sta., Bull.* 106).—Experiments have been carried out at a large number of centres in districts where lucerne is not easily grown, with a view to determining the best means of securing a profitable stand on various soils. Quarter acre plots were laid out, and dressings at the following rates were applied: (1) 12 tons farmyard manure per acre, (2) 3,000 lb. lime per acre, (3) 300 lb. bone meal per acre, (4) no treatment. Each of these plots was subdivided into three; one-third received no treatment, another third was inoculated with soil from an old lucerne field, and the remaining third in addition to inoculation was to be cultivated after each cutting of the crop with a disc or spring tooth harrow. At a considerable number of centres it was found altogether impossible to obtain a successful crop; at most of these the subsoil—a very stiff clay—appeared to be the factor responsible. Of the fifty-eight successful trials, farmyard manure proved beneficial in 86 per cent. of the cases, bone meal in 65, and inoculation in 62. The soils were well supplied with lime to start with, and in only about 10 per cent. of the cases did the special application appear to have aided in securing a successful crop. Where thorough cultivation was carried out after each cutting, it was found to keep down the grass and weeds which constitute one of the great difficulties in growing lucerne on many soils in the State.

LIVE STOCK AND FEEDING STUFFS.

Sheep Crossing Experiments (*Yorks. Council for Agric. Educ. and Univ. of Leeds, Guide to Experiments*, 1912).—Experiments have been conducted at the Manor Farm, Garforth, since 1898 to compare the results obtained with various breeds of rams and different classes of ewes. In 1912 Lincoln and Wensleydale rams are being tested with Lincoln and North Country (Border-Leicester—Cheviot cross)

Rams.	LINCOLN EWES.				NORTH COUNTRY EWES.			
	Ratio of Ewes served to Lambs born.	Carcass Weight of Hoggs.	Hogg Wool.	Receipts per Ewe comprising Lambs, Hoggs, and Hogg Wool.	Ratio of Ewes served to Lambs born.	Carcass Weight of Hoggs.	Weight of Hogg Wool.	Receipts per Ewe comprising Lambs, Hoggs, and Hogg Wool.
		lb.	lb.	£ s. d.		lb.	lb.	£ s. d.
Lincoln ..	1 : 1·3	73	12·6	2 6 0	1 : 1·5	73	10·3	2 16 11
Shropshire ...	1 : 1	67	10·0	1 9 1	1 : 1·5	69	8·1	2 3 2
Hampshire ...	1 : 1·3	79	10·3	2 10 5	1 : 1·6	76½	8·2	2 18 2
Oxford... ...	1 : 1·2	74	11·1	2 5 10	1 : 1·6	76	9·0	3 1 8
Suffolk... ..	1 : 1·2	73	9·0	1 11 11	1 : 1·75	76½	7·8	3 1 3
Wensleydale	1 : 1·25	72	11·6	2 6 3	1 : 1·65	72½	9·35	3 0 1
Leicester ...	1 : 1·4	67½	11·8	2 1 5	1 : 1·5	75	9·5	2 9 1

ewes. Particulars of the results obtained from 1898 to 1910 inclusive are given in the table on p. 576. It should be noted that a Lincoln ram had been used each year; Oxford rams from 1898 to 1908; a Hampshire ram up to 1906; Shropshire and Suffolk rams up to 1902; a Wensleydale ram each year from 1899 to 1905, and again in 1909 and 1910; a Leicester ram was used from 1899 to 1902.

From 1906 to 1910 Masham ewes (Wensleydale—Blackface cross) were tested along with the others.

Studies of the Protein Nutrition of the Pig (*Univ. of Wisconsin Agric. Expt. Sta., Research Bull. No.* 21).—It is known that proteins from various sources differ widely from one another in fundamental characters, and cannot be regarded as being of equal value as nutrients for animals. Some proteins, such as casein and vitellin, have been shown to be capable of maintaining an animal in nitrogen equilibrium; others, such as zein and gelatine, have been found not to possess this power. The amino acids which all proteins yield on hydrolysis are regarded as the materials from which the animal builds up the proteins of its body, and it is assumed that the animal has no synthetic power of producing from other compounds the amino acids it needs, with the single exception of glycocoll. From this it follows that the greater the similarity of the proteins in the food to those of the body of the particular animal, the greater will be their food value to the animal.

Distinction is drawn between endogenous metabolism and exogenous metabolism. The former is practically constant, represents cellular processes, and results in the formation of a distinct group of products, the only one of which we have definite knowledge being creatinin. Exogenous metabolism represents the prompt conversion of the nitrogen of the food into products of another class, of which the chief is urea. It was concluded that if an animal is fed on a nitrogen-free diet of starch, ash, and water, the exogenous protein metabolism would be reduced to vanishing point. Pigs were so fed for periods ranging from 21 up to 36 days, and it was found that at the end of these periods there was established a fairly constant ratio between the nitrogen occurring as creatinin and the total amount in the urine. This was about as 18·5 is to 100, or 1 to 5·5, and it is concluded that the nitrogen eliminated when this nearly constant ratio is reached represents the absolute minimum level of protein metabolism of which the animal is capable, and that if nitrogen equilibrium is to be maintained, at least this amount must be supplied in the food and in a utilisable form.

In pigs, therefore, the maintenance level for nitrogen of particular animals can be arrived at by finding the average amount of creatinin nitrogen appearing in the urine when no flesh or animal food (*i.e.*, a creatin and creatinin free diet) is being fed and multiplying by 5·5. Whether this factor will apply to other species of animals is not yet known.

Having established this fact, experiments were carried out with pigs, feeding single foods and pure protein of various kinds in addition to the starch and ash diet when exogenous metabolism had been eliminated as shown by the approach to the ratio explained above. The extent to which the protein fed had been utilised in replacing tissue daily catabolised was calculated from the difference between the amount of nitrogen fed and the extra quantity appearing in the urine. The results may be summarised as follow: (1) The differences in the nutritive value of the protein of wheat, oats, and maize are not so great as would be expected from the known differences in their chemical composition. (2) Pigs can utilise the nitrogen of zein very efficiently for *repair* of losses due to endogenous metabolism. Gelatin is less useful, being utilised to the extent of 50 or 60 per cent. as compared with 80 per cent. in the case of zein. (3) No evidence was obtained of the formation of *additional* body tissue from zein even when fed in excess. (4) Experiments in feeding casein as the only protein resulted in increases of the body protein of 20 to 25 per cent.

It is concluded that the repair processes in an animal's body are different from the processes of growth, and that the processes of cellular catabolism and repair do not involve the destruction and re-synthesis of an entire protein molecule.

The Feeding of Coconut Cake to Milch Cows (*Jour. South-Eastern Agric. Coll., Wye, No.* 20, 1911, Mr. S. Skelton).—An investigation was carried out on the College Farm during the months of April and May, 1911, to determine the suitability of coconut cake as a food for the production of milk and butter. Three cows, which had calved about two months previously, were selected, and, after being fed for a fortnight on an ordinary ration, were given a diet containing coconut cake, the quantity fed being at first 2 lb. a day, and gradually increased to 6 lb. per head daily. The total period in which the coconut cake was fed was three weeks, after which the cows were kept under observation for a week, during which time they received ordinary foods. The coconut cake appeared to produce very little effect on the yield and quality of the milk, and on the Reichert number of the butter, though in view of the shortness of the period and the small number of cows it is impossible to draw definite conclusions. It was clear, however, that the cake made the butter much firmer, and it is suggested that on this account it should prove useful as a food in warm weather when difficulty is experienced in making firm butter.

Effect of Various Foodstuffs on Milk Secretion and Fat Content of Milk (*Fühlings Landw. Ztg.*, May 15th, 1912).—The work of various experimenters during the last few years as to the effect of various food stuffs on the milk secretion of cows and on the fat content of the milk is reviewed in this publication by Hansson, of the Stockholm Agricultural Experiment Station.

He concludes that there are distinct differences between various foods in these respects, but that the specific effect of any food varies with varying circumstances, *e.g.*, according to the kind of cow and the composition of the different rations in which the food under consideration is included. On this account he concludes that it is impossible to express definitely the relative values of foods in these respects, but that their tendency in one or the other direction alone can be stated. Palm nut cake, coconut cake, cottonseed cake, linseed cake, pea and bean meal, sugar beet leaves and tops, and probably hay are given as foods tending to increase milk secretion and fat content.

Sesame cake, soy bean cake, maize, roots, sugar beet slices, and probably all foods rich in sugar, are stated to have a favourable effect on milk secretion, but to tend to lower the fat content slightly. Poppy seed cake, probably rice meal, and all frozen or very cold foods tend strongly to lower the fat content.

Feeding Value of Milling Offals (*Zeit. f. d. ges. Getreidewesen*, August, 1912).—Experiments carried out by Honcamp at Rostock Experiment Station as to the digestibility of the *germ* of the grains of wheat and rye gave the following results:—

	Proportions digested.			
	Wheat Germ.		Rye Germ.	
	Sheep.	Swine.	Sheep.	Swine.
	Per cent.	Per cent.	Per cent.	Per cent.
Dry matter	86·7	84·9	89·1	83·5
Organic matter	89·3	86·9	91·7	86·4
Crude protein	93·8	90·1	91·8	90·8
N-free extract substances ...	91·4	88·1	91·5	87·8
Crude fat	89·4	85·5	90·3	72·2
Crude fibre	—	41·3	91·0	67·7

It is recommended that not more than ½ lb. per head per day should be fed to swine, 1 lb. to sheep, and 2–3 lb. to cattle. The germs are rich in albuminoids, and should be regarded as a complementary food to meals, bruised grain, &c. On account of their high fat content, both quickly become rancid, and care should be taken to secure freshly prepared germ.

Bran is distinguished from other milling offals in being poorer in carbohydrates and richer in fibre and ash, and therefore less digestible. With the increasing efficiency of milling machinery, the feeding value of bran and pollards has decreased. Feeding trials with sheep with various samples of rye and wheat bran gave the following results:—

	Digestible constituents (per cent.)				
	Total Organic Substances.	Protein.	N-free Extract Substances.	Fat.	Fibre.
Rye Bran:—					
Roughly milled ...	79·0	10·9	65·8	2·0	0·3
Intermediate	76·0	13·4	57·8	2·7	2·1
Completely milled ...	71·6	15·1	51·2	1·5	3·8
Wheat Bran:—					
Roughly milled ...	74·0	14·5	45·9	3·5	6·1
Intermediate	68·0	13·9	45·2	3·9	5·0
Completely milled ...	60·5	12·4	40·4	4·1	3·6

In Germany rye bran is chiefly used for fattening animals, while wheat bran is usually fed to dairy cows; not more than 4½–6½ lb. per head per day are recommended for fattening and dairy cattle, and 1⅛ lb. to 2¼ lb. for sheep and swine.

Specific Effect of Foods on Milk Production (*Die landw. Versuchs Stationen*, Band LXXVII., Heft I. u. II.).—An account of experiments carried out at the experiment station at Hohenheim, with regard to the specific effect of foods on milk production, is given, and the results compared with those obtained by other experimenters in this direction. The following conclusions are reached:—

(1) That many feeding stuffs have a specific effect on milk production.

(2) That this specific effect may be in two directions—

(*a*) on the yield of milk and of its constituents, especially fat;

(*b*) on the quality of the milk fat.

(3) That the effect on the milk yield is chiefly due to stimulating substances in the foods fed to cows. Among such are included substances which have a pleasant smell and taste, those which have no smell (*e.g.*, salt), and non-albuminoid nitrogen compounds—in fact, all substances which have physiological effects, but which are present in feeding stuffs in only small quantities, and do not come into consideration as supplying nourishment or energy.

(4) That the influence on the quality of the milk fat is to be ascribed chiefly to the fat in the foods fed; it is possible that other constituents of foods fed may have some effect in this direction, but no experiments have as yet proved this.

Feeding Value of Sawdust (*Die landw. Versuchs Stationen,* Band LXXVIII., Heft I. u. II.).—Reference is made in this publication to feeding trials carried out by German experimenters in 1890 and succeeding years with sawdust, both crude and prepared in various ways, the results of which showed the sawdust, both prepared and unprepared, to have a very low feeding value. More recent experiments by Pfeiffer with molasses mixed with sawdust showed that the sawdust was not only completely undigested, but that the digestibility of the whole of the ration was decreased as a result of the inclusion of the sawdust.

The present experiments were carried out at Rostock with crude sawdust (of coniferous trees) and sawdust treated with sulphuric acid under pressure. None of the crude sawdust was digested, and its presence in the alimentary canal caused a decrease in the digestibility of the other foods in the ration. The preparation of the sawdust added to the digestibility of the nitrogen-free extract substances by converting some of the crude fibre into easily soluble and assimilable carbohydrates (mainly dextrose). The protein and the unchanged fibre of the prepared sawdust, however, were not only not digested, but decreased the digestibility of these substances in the other foods of the ration. No better utilisation by animals of the prepared sawdust was obtained by mixing with molasses.

It is concluded that sawdust, either treated or untreated, is not at all a suitable substance with which to mix molasses.

OFFICIAL NOTICES AND CIRCULARS.

Foot-and-Mouth Disease.

Since September 9th, the date of last month's article on this subject, no fresh centres of foot-and-mouth disease in hitherto unaffected parts of the country have come to light. Further outbreaks of the disease have, however, been discovered at Grimsargh, in the Lancashire area, at Cove, in the Hampshire area, and at Capheaton, Belsay and Bingfield, in the Northumberland area. In addition, on September 18th, the disease was confirmed to exist on premises at Walker, Newcastle-on-Tyne, and on September 24th at West Boldon, Gateshead, in a part of the Northumberland and Durham area from which restrictions had been withdrawn. It was therefore necessary to re-impose in this district the restrictions entirely prohibiting the movement of all animals. No further outbreaks have, however, been found in the neighbourhood, and modifications have been made to permit of the movement of animals for slaughter.

No cases of the disease have been found outside Northumberland and Durham since September 14th, and restrictions have now been entirely withdrawn from Leicester, Somerset, and Cheshire.

In all, 81 outbreaks have now been confirmed during the year up to October 7th, distributed as follows:—

County.	No. of Outbreaks.
Cheshire	7
Cumberland	3
Durham	2
Flint	1
Hampshire	2
Lancashire	9
Leicester	3
Northumberland	32
Salop	1
Somerset	2
Stafford	1
Surrey	1
Sussex, East	4
Yorkshire, East Riding	2
,, West Riding	12
	82

Report of the Animals Division.

The annual report of the Board of Agriculture and Fisheries on the Proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, &c., for the year 1911 has been recently issued [Cd. 6136, price 1s.]. The report describes the steps taken both from a veterinary and an administrative point of view, in connection with the outbreaks of foot-and-mouth disease, swine fever, glanders, anthrax, and sheep scab in 1911, and contains an account of the investigations conducted during the year at the Board's Veterinary Laboratory.

Landing of Irish Store Cattle in England.

The Board of Agriculture and Fisheries have made an Order, dated October 4th, 1912, which allows cattle which have been shipped in Ireland at any of the ports of Belfast, Cork, Dublin, Londonderry, and Waterford, to be landed at special landing places at Birkenhead, Manchester, Cardiff, Hull, and Newcastle-on-Tyne. Cattle so landed are required to be detained at the landing place until a period of not less than four days has elapsed from the time of sailing from Ireland, during which period they will be marked, examined, and kept under continuous supervision by veterinary inspectors of the Board. If all the cattle then in the landing place are certified to be free from foot-and-mouth disease, the cattle may be moved direct to the buyers' premises by the licence of an Inspector of the Board, if such movement is not contrary to the provisions of any Order of the Board or regulation of a local authority controlling the movement of cattle into a district in Great Britain. Cattle so moved are required to be kept separate from other animals during transit, and on arrival they are required to be detained and kept under the supervision of a veterinary inspector of the local authority for a period of twenty-one days. During this period of detention the cattle must be isolated from all other animals. They may, however, with the written authority of an inspector of the local authority, be allowed to come in contact in the place of detention with other animals, but in that case all the animals will be subject to detention and isolation.

The Department of Agriculture and Technical Instruction for Ireland will make arrangements for the examination of every animal by a veterinary inspector prior to shipment, and for its detention for not less than two hours, during which time it will be fed and watered.

MISCELLANEOUS NOTES.

Bredon Pig Club.

The parish of Bredon, in Worcestershire, has a total acreage under crops and grass of about 2,500 acres, of which 1,700 are under permanent grass. It is in a good fruit-growing district, and has some 285 acres under fruit. Of the holdings above one acre about 30 are under 50 acres in area. There are in the parish about 350 pigs, of which more than 50 are sows, kept for breeding. The breed favoured is generally a cross between the Yorkshire and Berkshire, and the cottager's "store-pig," kept for fattening, runs up to about 16 score (320 lb.) and averages, when killed, about 250 lb. in weight, and £5 or £6 in value.

In 1878 a pig-club was started for the parish of Bredon, its object being "the insurance and relief of each of the members who may have the misfortune to lose a pig." The club now consists of 90 members, most of them working-men, though it also includes one or two small farmers, builders, and other villagers. There is no limit to the number of pigs a member may insure, and recently a poultry-farmer insured six sows; some of the members insure two or three pigs, but the great majority insure only one pig each. Few of the pigs are kept for sale, most of them being fattened for the consumption of the owner and his family. The cottager usually buys in spring a store-pig about 10 weeks old at a cost of from 10s. to £1, begins to fatten it in midsummer, and kills it in early winter before it is a year old. He therefore has it in his possession only after it has survived the risks of infancy and castration, and while it is in its vigorous youth, and least liable to disease. No pig is insured under the age of nine weeks.

The number of pigs insured, which eight years ago was 109, is now 144, of which 14 are sows, and the rest store-pigs. A new member insuring a store-pig has to pay an entrance fee of 1*s*., and wait for three months before he becomes entitled to any benefit. He then pays, at the rate of 1*d*. per week, 1*s*. 1*d*. per quarter to the insurance fund, and 2*d*. per quarter to the management fund, or altogether 5*s*. a year. When he has made these payments for four years, and thus has paid the club £1 1*s*. altogether, he becomes a "free member," and pays no further, contribution to the insurance fund, so that thereafter his total payment is only 8*d*. a year to the management fund, in return for which his successive pigs, one at a time, if marked as accepted by the club, remain insured, year after year, to their full value against death from disease or accident. For a breeding-sow or boar he pays 2*s*. 6*d*. entrance fee and 2*s*. 2*d*. a quarter for four years, with 8*d*. per annum to the management fund, or £1 19*s*. 10*d*. altogether, and then his contribution of 8*d*. a year to the management fund is all he need pay to keep his sow or boar insured. He is liable to a special levy, should the funds available not be sufficient to meet the losses in any year; but seeing that the Club has now a reserve fund of £155 in the Savings Bank, there is practically no risk of any such levy having to be made.

On the average of the last nine years the number of pigs insured was 124; the total number of pigs on which claims had to be paid was 13, which gives an average rate of mortality of 1·2 per cent. per annum. In three of the nine years no pig died, and in the worst year 5 pigs died out of 108, giving a death-rate for that year of 4·6 per cent. The amount paid on claims in the nine years was £48 17*s*., which gives an average of £5 8*s*. 7*d*. per annum, of £3 15*s*. per pig paid for, and of 10½*d*. per pig insured. Against this loss there was an income during the nine years from contributions to the insurance fund by way of premiums of £50 6*s*. 5*d*., giving an average per annum of £5 11*s*. 10*d*. in all, and of 11*d*. per pig insured. Thus the premium income in itself a little more than covered the losses. But besides this there was an income from interest on the reserve fund averaging £3 5*s*. 8*d*. a year, and altogether the income of the insurance fund averaged £9 7*s*. 4*d*. a year, while the expenditure averaged only £5 8*s*. 7*d*., so that the amount at credit of that fund increased during the nine years from £120 to £155. Even in the bad year, though the Club paid £17 7*s*. on the five pigs that died, it had to draw on its reserve fund only to the extent of £7.

The costs of management are met from a separate fund, to which the members contribute 8*d*. a year each; this gave an average income of £3 0*s*. 4*d*., which covered the average annual expenditure of £2 19*s*.

The affairs of the Society are managed by a Committee of ten members, almost all working men, several of whom are employed on the railway. There are three trustees, of whom two are innkeepers and one a builder. The president is a pork-butcher, and the secretary, to whom much of the success of the Club is due, is a market-gardener, who has held the post since the club started 34 years ago. The accounts are audited by the station-master and post-master, and a copy of them is sent annually to the Registrar of Friendly Societies. The president's duties involve some responsibility, as he has to pass as sound all pigs offered for insurance, and when a pig falls ill, has to go and value it, and see that the owner does all in his power to cure it. If the pig dies, its carcass is weighed, and the club pays the owner his loss at the rate of 10*s.* per score of lb. weight. The largest sum paid for a single pig during the last nine years was £5, and the smallest £1 5*s.* The carcass is invariably buried.

The excellent position this club has attained is due to the care taken of their pigs by the members, to the fairness with which they act towards each other, to the attention paid to the affairs of the club by its committee-men and office-bearers, and to their having passed a rule that, instead of dissipating their reserve fund by distributing any portion of it as a dividend among the members, it should be utilised to relieve from contributions to the insurance fund all members of more than four years' standing.

Small Holdings and Allotments Societies in 1910.

Particulars relating to the operations, during 1910, of land societies registered under the Industrial and Provident Societies Act, 1893, are given in the Report of the Chief Registrar of Friendly Societies for 1910 [H.C. 159–II. Part B]. These societies are divided into (*a*) societies comprising the ordinary land purchase societies, and (*b*) small holdings and allotments societies, the former comprising societies purchasing and owning land for resale to members, principally for residential purposes, and the latter for the acquisition of land for the promotion of small Holdings and allotments, either under the Industrial and Provident Societies Act alone, or in conjunction with the Small Holdings and Allotments Act.

The returns of 163 small holdings and allotments societies at the end of 1910 show an aggregate membership of 10,241. The productive expenses amounted to £288, and distributive expenses to £1,049; other expenditure amounted to £80. The balances of the trading departments resulted in 24 societies in a profit of £156, and in 14 societies in a loss of £264. In their small holdings and allotments departments rent was received amounting to £14,233, and other income to £2,437. The disbursements for rent, rates, and taxes amounted to £12,476, management expenses to £2,111, while other expenditure amounted to £1,565, the balance of the operations being in 36 societies a profit of £1,023, and in 18 societies a loss of £505. In this respect it should be borne in mind that the formation expenses of newly established societies, such as those under consideration, are necessarily heavy in the earlier years of existence, while the sources of revenue are undeveloped.

The share capital of members of small holdings and allotments societies amounted to £10,212, and loan capital and other expenses to £9,142. Buildings, fixtures, and land owned by the societies and employed in their operations were valued at £4,572. Investments and other assets were valued at £11,632.

It appears from the returns giving the information that 6,952 acres have been acquired as small holdings at an annual value of £11,662; allotments comprise an area of 1,259 acres at an annual value of £1,858; while grazing and other rights over 294 acres are valued at £455 per annum. The number of tenants occupying the foregoing land was returned as 6,307.

Production of Sulphate of Ammonia.

THE report of the Chief Inspector of Alkali Works for 1911 (*H.C.* 197, 1912), shows that there were 570 works or separate processes for the manufacture of sulphate and muriate of ammonia in England and Wales, as compared with 543 in 1910 and 536 in 1909, the number having steadily increased from 449 in 1904. In Scotland the number of such works was 106. There were also 56 gas liquor works in England and five in Scotland.

Sulphate of ammonia is chiefly obtained as a bye-product from coal. When this is treated for the production of coal-gas or for the manufacture of coke used in iron smelting, an "ammoniacal liquor" results, which forms the raw material for the manufacture of ammonium salts. The distillation of the bituminous shales used in the Scotch paraffin industry also yields a certain amount, and the ammonia produced in other manufactures in which coal and similar substances are used, in iron works, from producer gas plants, and from carbonising works, is also collected. The quantity of sulphate of ammonia produced in the United Kingdom is shown in the following table:—

Source.	1911.	1910.	1909.
	tons.	tons.	tons.
Gas works	168,783	167,820	164,276
Iron works	20,121	20,139	20,228
Shale works	60,765	59,113	57,048
Coke-oven works	105,343	92,665	82,886
Producer-gas and carbonising works (bone and coal)...	29,964	27,850	24,705
Total	384,976	367,587	349,143

These figures show an increase over the production of 1910, with the exception of iron works, which remained practically stationary. The supply from coke ovens shows an increase of nearly 13,000 tons. In 1904 the production in coke-oven works was only 20,000 tons. The total production in 1911 was 385,000 tons, and 292,000 tons were exported, so that the balance remaining for home consumption for all purposes amounted to 93,000 tons, as compared with 84,000 tons in 1910 and 85,000 tons in 1909. The exports of sulphate of ammonia are principally to the United States, Japan, Spain, Dutch East Indies, British West Indies, and Italy.

The largest industrial source of sulphate of ammonia is still the widely distributed and important manufacture of illuminating gas from coal, but the relative proportion as compared with the total production is becoming less, owing partly to advances in methods of gas manufacture which permit of a greatly increased production of gas per ton of coal carbonised, and partly to the rapid growth of the more recent processes for recovery of bye-products from coke-oven gases, and from producer gas.

During the past year much attention was attracted to methods by which ammonia present in crude gas, either from the gas retort or from the coke-oven, could be obtained in the form of a solid salt fit for sale, but without the necessity of providing sulphuric acid, as is the case at present in all works producing sulphate of ammonia.

In the table below are shown the imports of the materials used in the fertiliser trade, the principal being mineral phosphates. A proportion of the nitrate of soda imported is used in the manufacture of sulphuric and nitric acids.

	1911.	1910.	1909.
	tons.	tons.	tons.
Guano	34,124	20,395	20,321
Mineral phosphates	493,413	455,593	451,807
Nitrate of soda	128,487	126,498	90,207

The figures show considerable increases compared with 1910.

The number of chemical manure works under inspection in 1911 was 159, as compared with 167 in 1907. In Scotland the chemical manure works numbered 37, or one less than in 1910.

Importation Regulations.

Importation of Grain and Seeds into the United States.—An Act of August 24th, 1912, prohibits the admission into the United States of certain adulterated grain and seeds unfit *for seeding purposes.* The adulterated and unfit seeds mentioned in the Act are those of alfalfa, barley, Canadian blue grass, Kentucky blue grass, awnless brome grass, buckwheat, clover, field corn, Kafir corn, meadow fescue, flax, millet, oats, orchard grass, rape, redtop, rye, sorghum, timothy and wheat, or mixtures of seeds containing any of such seeds as one of the principal component parts.

Seed of red clover is considered to be adulterated if containing more than 3 per cent. by weight of seed of yellow trefoil, or any other seed of similar appearance to, and of lower market value than, seed of red clover; seed of alfalfa if containing more than 3 per cent. by weight of seed of yellow trefoil, burr clover, and sweet clover, singly or combined; any seeds or mixtures of seeds mentioned above if containing more than 5 per cent. by weight of seed of another kind of lower market value and of similar appearance (except, however, the mixture of the seed of white and alsike clover, red and alsike clover, or alsike clover and timothy).

Seed of any kind of clover or alfalfa is considered to be unfit for seeding purposes if containing more than one seed of dodder to five grams of clover or alfalfa seed respectively. Any seeds or mixtures mentioned above are considered unfit if containing more than 3 per cent. by weight of seeds of weeds.

Adulterated or unfit seed may, however, be imported under bond for cleaning.

Importation of Live Stock into Australia.—Under the Quarantine Act of 1908, the Australian Government have issued a Proclamation, dated July 18th, 1912, prohibiting the importation into the Commonwealth of cattle, swine, sheep, and goats from the United Kingdom, owing to the existence of foot and mouth disease in England. (*Board of Trade Journal*, September 12th, 1912.)

Importation of Live Stock into South Africa.—In consequence of the outbreak of foot and mouth disease in England, the Government of the South African Union have issued a Proclamation (No. 114 of 1912), dated July 10th, prohibiting the importation into the Union of South Africa of cattle, sheep, goats, and pigs from any part of Great Britain and Ireland. (*Board of Trade Journal*, August 22nd, 1912.)

Importation of Feeding Stuffs into Sweden.—A Swedish Royal Decree of March 19th, 1912, provided that *new* bags must be used for feeding stuffs imported into Sweden from any country infected with foot and mouth disease. The term "feeding stuffs" includes:—

(1) Bran, all kinds.

(2) Oil cakes; cakes made of maize flour pressed together; acorns, ground or not; also arachides or earth nuts.

(3) Other cattle food, such as brewers' grains and wash, gluten food, meal of maize cakes and other oil cakes and maize-germ meal, even if with admixture of animal substances. (*Board of Trade Journal*, September 19th, 1912.)

Agricultural Exhibitions Abroad.

International Horticultural Exhibition at St. Petersburg in 1913.—An international horticultural exhibition will be opened at St. Petersburg at the end of April, 1913. It will be organised by the Russian Imperial Horticultural Society. The exhibition will comprise an agricultural section in addition to various floricultural and horticultural sections. Intending foreign exhibitors must give notice of their intention to exhibit to the Comité Exécutif de la Société Impériale d'Horticulture de Russie, St. Pétersbourg, Quai de la Cour, 32, before January 1st, 1913. A copy of the regulations, programme, and awards may be seen at the office of the Board, 4 Whitehall Place, London, S.W.

Notes on Agriculture Abroad.

Admission of Articles into Belgium for the Ghent Exhibition.—By a Belgian Royal Decree, dated July 30th, temporary exemption from Customs duties is accorded to foreign products imported for the International Exhibition to be held at Ghent in 1913, subject to eventual re-exportation and to compliance with the Customs formalities to be determined by the Minister of Finance.

Statistics of the Dairy Industry of Canada.—A census of the production of butter, cheese, and condensed milk in Canada in 1910 was taken in 1911, and the results have been published in the *Census and Statistics Monthly* for March, 1912.

There were 3,628 factories in operation in 1910 for the manufacture of butter, cheese, and condensed milk. The quantity of butter made in the year was 59,875,000 lb., valued at £3,267,000, or an increase over the production in 1900 of 23,818,000 lb., and £1,759,000. The quantity of cheese made was 231,013,000 lb., or an increase over that manufactured in 1900 of 10,180,000 lb., but the value shows a decrease of £125,000.

The number of condensed milk factories in operation increased from four in 1900 to twelve in 1910, and the value of the product increased from £56,000 to £383,000.

The average price of factory butter in 1900 was 10*d.* per lb., and of cheese 5*d.* per lb., while in 1910 the prices were 1*s.* 1*d.* and 4½*d.* per lb. respectively. The increased price of factory butter led to a larger production in 1910 than in 1900, and this was made, especially in Quebec, at the cost of a lower production of cheese. The change was further induced by the lower rate of duty on cream in the United States, which encouraged larger exports to that country.

State Grants to Live Stock Shows in Uruguay.—The sum of £10,625 has been allotted, in the Uruguay Budget for 1912, for grants to live stock shows and fairs. Subsidies will be granted to associations that promote such shows, but not to private persons. Special prizes will be given in respect of (*a*) the breeding of horses, cattle, sheep, and pigs; (*b*) dairy produce, and (*c*) those farms which have the greatest extent of seed-leas. (*Bull. Bur. Agric. Int. and Pl. Dis.*, June, 1912.)

Development of Agriculture in Hungary.—A good deal is being done by the Hungarian Government to encourage activity in the various branches of agriculture, including (*a*) horticulture and fruit growing, (*b*) stock and poultry breeding, (*c*) dairy farming, (*d*) meadows and pastures, (*e*) horse-breeding, (*f*) bee-keeping, and (*g*) veterinary instruction. With regard to horticulture, courses of instruction extending over two and three years have been instituted. A sum of £7,200 has been spent on the improvement of meadows; and subventions are also granted to the co-operative dairies, of which there are 555 at work. Horse-breeding is receiving considerable attention. (*Bull. Bur. Agric. Int. and Pl. Dis.*, June, 1912.)

Statistics of Agricultural Labour in Sweden.—An inquiry was carried out in 1911 into the conditions of agricultural labour in Sweden, by means of questions addressed to presidents of the communal councils of 2,275 rural communes (these representing 95 per cent. of the total number of rural communes in the country).

In 112 communes (4·9 per cent.) the supply of agricultural labour was "good"; in 1,409 (62·0 per cent.) it was "sufficient"; and in 740 (32·5 per cent.) it was "insufficient"; no precise statement on the question could be given in fourteen communes.

The average daily duration of labour during the three summer months for the whole country was found to be 12·7 hours; this, however, included 2·2 hours for meals and rest, so that the number of hours per day in which work was actually going on was 10·5. It must be explained, however, that this refers to labourers in the fields,

&c., only, and not to stablemen and stall attendants, whose day's labour is considerably longer.

The average wages received by an unmarried male farm servant were £17 6s. per annum, but to this must be added the average value of the food and lodging received, which is reckoned at £18 14s., bringing the total wages to £36 per annum. The corresponding amounts for a female unmarried farm servant were £10 4s., £15 2s., and £25 6s. In addition to food and lodging, farm servants in the north of Sweden often receive clothing.

The average wages of ordinary ploughmen (generally married) were £17 9s. per annum in money, but this, it is estimated, is raised to a total of £38 3s. per annum by payments in kind of milk, grain, potatoes, &c., and housing—the cottage in the south of Sweden generally consisting of two rooms and a kitchen, and in other parts of the country more often of one room and a kitchen. In the above total the value of the cottage has been reckoned at £3 11s. per annum, and of fuel at £2 6s. per annum.

Animal attendants receive higher wages in money and more important payments in kind, the total having been estimated at £41 14s. per annum.

Besides the above labourers, permanent day labourers working from six months to about a year for the same employer were employed at 2s. 8d. per day in the summer, and 2s. in winter. These labourers were hardly ever, if at all, paid in kind, and the employer deducted 10d. a day in summer and 9d. a day in winter from the above wages for food. Occasional day labourers received 3s. 1d. per day in summer, and 2s. 3d. per day in winter. If food was provided by the employer, the wages were reduced by 11d. and 10d. respectively.

Among the day labourers, a large number of women were employed in the cultivation of beetroot, potatoes, &c., and in the harvesting of hay and corn. The average wages of these women, if they formed part of the permanent farm staff, were 1s. 8d. per day (without food) in summer, while if they were occasional labourers their wages were slightly higher than this. The wages in winter were much lower.

Agricultural Activity in Greece.—A determined effort is being made by the Grecian Government to promote agriculture and improve the condition of the peasant population of the country. At present agriculture is in a very backward condition. The alluvial soil of the valleys is remarkably fertile, but agricultural improvements have been deplorably neglected. Little attention has been paid to drainage. Roads are few, transport is in consequence costly, and the use of labour-saving implements restricted.

The recent activity on the part of the Government makes the prospect, however, more encouraging. An Act has been passed to abolish the old and faulty form of municipal administration, and, under the new arrangement, each village will form a district community possessing a form of local government, which it is anticipated will induce the villagers to combine and devote part of the local revenue to necessary improvements.

Foreign agricultural experts are being employed to organise different branches of agriculture.

An effort is being made by the Ministry of Agriculture and Commerce to increase the cultivation of cotton and to improve the quality by the introduction of new varieties.

The Government has taken in hand the drainage of the bigger marshes, which cannot be left to local effort, with the view of adding to the productive land of the country.

A factory for the manufacture of artificial manures has been established at Piræus, and a good and increasing demand is being met with for the products. (*F.O. Reports, Annual Series,* No. 4868.)

Cost of Producing Crops in Canada.—The Cánadian Census and Statistics Office made a special inquiry early in 1912, through its crop reporting correspondents, as to the cost of producing wheat, oats, barley, maize, and flax in 1911. Each correspondent was requested to give average figures fairly representing the conditions in the neighbourhood, and based upon his knowledge of those conditions, as well as upon his own practice as a farmer.

The average results per acre for the whole of Canada are summarised in the following table:—

	Autumn Wheat.		Spring Wheat.		Oats.		Barley.		Flax.		Maize.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Preparation...	16	4	12	11	12	7	12	4	12	10	17	11
Seed	6	9	7	3	5	3	5	7	6	3	3	8
Seeding ... ... Cultivation	4	2	4	2	3	9	4	2	3	8	14 12	0 5
Harvesting and preparing for market ...	7	2	6	5	6	7	6	5	5	4	13	3
Threshing	8	8	9	8	11	2	9	4	10	10	14	8
Wear and tear of implements...	1	7	2	0	1	10	1	9	1	9	2	3
Rental value	11	9	11	2	11	2	11	1	11	5	12	11

	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Total... ...	2	16	6	2	13	7	2	12	6	2	10	9	2	12	2	4	11	2
Value of produce	4	6	0	3	10	6	3	9	6	3	14	5	4	2	8	6	13	10
Profit... ...	1	9	6	0	16	11	0	17	0	1	3	8	1	10	6	2	2	8
Yield (bushels)...		22			21			41			31			12			54	

The cost of applying manure (if any) is included in the cost of preparing ground for seed. The cost of cultivation includes all costs from the time of planting the crop until it is ready to harvest. The value of the by-products, *i.e.*, straw and flax fibre, has been reckoned as set off by the value of the farmyard manure applied, so that neither of these items appears in the above table.

Although no claim to absolute accuracy is made for the above results, the data are of value as furnishing for the first time in Canada some indication of the average costs and approximate profits of grain production.

The profits from grain growing in 1911 were apparently higher in Quebec than in any other province, except British Columbia. Artificial manures are in general use in Nova Scotia only. (*Census and Statistics Monthly,* March, 1912.)

Live Stock Industry in Holland.—Each province of the Netherlands possesses a Committee for the promotion of animal breeding, which administers the subventions granted by the State for premiums, purchase of breeding animals, and breeding and milk control societies.

There are three herd books, the oldest dating from 1875, and in addition much is done towards improving the breed of cattle by the provincial societies, 125 in number, and by milk control unions.

An arrangement which is of great value to breeders of live stock in the country, as well as very convenient to foreign purchasers of Dutch live stock, is that instituted by a Decree of September 11th, 1908, by which animals destined for export may be submitted to an official veterinary examination, and a certificate issued based on the results. The veterinary examination consists of a clinical test, followed by the tuberculin test. As, however, in some countries little importance is attached to the latter, it may be dispensed with at the express wish of the purchaser. In cases where the tuberculin test is carried out, the temperatures of the animal before and after inoculation are noted in the certificate. The cost of the examination amounts to 12*s*. 6*d*. per head for five animals or less, and 10*s*. per head for six or more animals. If the tuberculin test is omitted the charges are 4*s*. 2*d*. and 3*s*. 4*d*. respectively.

The total expenditure by the State in respect of the improvement of the cattle industry in 1910 was £6,000. The provincial societies, which are in part entrusted with the distribution of the subventions, received altogether about £9,000, including £4,250 from the State and £4,600 in contributions from societies and private persons. This sum was spent mainly in the establishment of bull-breeding centres, and premiums were given for 4,300 cattle. Some provincial committees import breeding animals from the other provinces of the Netherlands.

The view is gaining ground that the improvement of the industry can best be promoted by the establishment and development of breeding societies; in 1910 there were 206 bull-breeding centres, 11 milk-control societies, and 133 other breeding societies.

Mutton is not popular, and sheep breeding may be said to have gone back during the last thirty years, although Oxford Downs, Leicesters, Cotswolds and Lincolns have been imported from England for crossing purposes.

Increasing attention is being paid to the breeding of goats, with the result that there has been a considerable increase in the number of these animals in recent years. Goats are chiefly kept by agricultural labourers and small-holders. The industry is subsidised by the State to the extent of £350 yearly.

Recently attempts have been made in North Holland to improve the native breeds of pigs. Breeding centres have been established, and good results have been obtained by the introduction of swine from Germany and Yorkshire. Some large farmers find it profitable to keep herds of purely English animals. In 1910 the State gave £400 to pig-breeding societies.

Cultivation of Sunflower Seed in Russia.—According to the report of H.M. Consul at Odessa (*F.O. Reports, Annual Series*, No. 4,965), sunflower seed has been grown on a large scale in Russia since about 1845, and there is a considerable demand for it. The seeds, raw or roasted, are largely eaten, and are thought wholesome and nourishing. The oil is used for the table, while the press residue, in the shape of oil cake, is a valuable food for cattle.

In growing the seed, the best results are obtainable from rich, moderately moist, but well-drained ground. Plenty of rain is needed during growth and flowering, and after then dry, clear, warm weather till cut. The yield varies from 6 to 18 cwt. per acre; probably the average farmer is contented with 7 to 8 cwt. per acre.

The seed is planted from 25 to 36 inches apart in both directions or in rows with the plants 20 inches apart, and the rows 40 inches apart. The leaves are not usually stripped, but lateral flowers would be removed so as to develop the terminal flowers.

In very dry seasons, and when the seed is over-ripe, it can easily be shaken out almost immediately after cutting, otherwise the heads have to be stacked or hung up to dry. After this the seed, especially when of a good size, can easily be shaken or beaten out and only the smaller seeds, which are of little or no value, remain, but even these fall out when two heads are rubbed one against the other. The various kinds of machinery devised for the separation of the seed do not seem successful, and most of them have soon been abandoned. Occasionally a wooden rasp or file is used. It is fixed slanting-wise so that the seed slides off it. Sometimes the heads are rubbed against strong wide-meshed wire netting. But all this seems unnecessary with easily separable seed, a quality which can be encouraged by planting seed which shows itself easily detachable.

After separation, the seeds are thoroughly ground without baking and then about half of the husk is blown away. The object in leaving half the husk is that, when pressed, the oil flows more freely and the husk absorbs the water. The nutritive value of the cake made from this process is high and the husk is thought to promote digestion.

The products differ in amount and in quality according to how the seed has been treated. It is estimated that from good dry sunflower seed, if first shelled and then pressed, there can be obtained from 18 to 24 per cent. of oil; when pressed with the husks, 14 to 18 per cent. The remainder, after allowing 5 to 12 per cent. for waste and moisture, is either press-meal and husk or the well-known oil cake. In sunflower seed the proportion between husk and kernel varies much according to variety.

The Norwegian Dairy Industry.—The American Consul at Stavanger reports that there are at present 35 dairies in his district, of which 29 are owned by stock companies, most of them being organised on the co-operative plan. In 1911 the total amount of milk consumed by all the dairies was 74,000,000 lb., or an increase of 8,000,000 lb. on 1910, the farmers being paid at the rate of about 6*d*. per gallon. The skimmed milk is used by the dairies for cheese-making, any surplus being sold back to the farmers at a cheap rate. Four new dairies were built in 1911, and the steady growth of this industry has opened up a market for several kinds of machinery, chiefly of the types used in hay-harvesting, which is the most important crop. In 1911 the city of Stavanger exported to foreign countries 88,490 pounds of butter, and 55,462 pounds of cheese. (*U.S. Daily Cons. and Trade Repts.*, No. 137.)

Hop Growing in Italy for Breweries.—Experiments which have been conducted for the last four years in Italy, with regard to the growing of hops for home consumption, show that the native hop possesses qualities suitable for the brewing industry. This result is important, inasmuch as Italy is estimated to consume nearly 26,000,000 gallons of beer per annum, and is at present entirely dependent on other countries for her hops. It is now expected that experiments will be conducted with barley, with a view to supplying malt for the Italian brewing industry. (*U.S. Daily Cons. and Trade Repts.*, No. 132.)

Budget of the Danish Ministry of Agriculture.—The estimated expenditure of the Danish Ministry of Agriculture for 1911–12 amounts to £290,456, viz., £241,062 ordinary expenditure, and £49,394 extraordinary expenditure. The budget of 1910–11 amounted to £291,646, the actual expenditure in that year being £279,315. (*F.O. Reports, Annual Series,* No. 4,962.)

Production of Nitrate in Chile.—The production of nitrate in Chile in 1911 reached the record total of 2,480,000 tons, an increase of 54,000 tons over 1910. The consumption of nitrate during 1911 increased by 108,000 tons. The United Kingdom consumed 10 per cent. more than in 1910, the United States 10 per cent., Holland 7 per cent., Belgium 7 per cent., France 4 per cent., and Italy 12 per cent., while Germany consumed about 4 per cent. less.

The industry made a good start in 1912, the production for the first three months of this year being greater than ever before for a like period, while the exports were very heavy. During March the exports showed an increase of 110,000 tons over March, 1911, while the consumption also greatly increased. A very prosperous year is expected. (*U.S. Daily Cons. and Trade Repts., Nos.* 79 *and* 119.)

According to the report of the Acting British Consul-General at Valparaiso (Mr. G. F. Atlee), a large number of new nitrate works were under construction in 1911, and during 1912 the available productive plant will be 20 per cent. greater than at any previous time. It is not expected, however, that the actual production will increase in that proportion, the supply of labour being deficient. It is estimated that the production in 1912 will be 2,535,000 tons.

It may here be noted that the grounds now being worked are known to contain nitrate sufficient to keep up the present supply for at least 30 years. The extent of nitrate grounds still in reserve has not been accurately ascertained, but it is certainly larger than the area now being worked, though the cost of production would, on the average, be higher owing to the fact that the contents of the reserve grounds are of somewhat lower grade. (*Board of Trade Journal*, September 26th, 1912.)

Agricultural Machinery in Siberia.—The following information is from the report by the British Vice-Consul at Omsk (Mr. S. Randrup) on the trade of that district in 1911: The imports into Siberia consist chiefly of harvesting machinery and agricultural implements, the greater part of the former being of American manufacture, although there are a few machines (mowers, rakes, and reapers) of Canadian and Swedish origin upon the market.

Ploughs are chiefly imported from Russia, but some of German origin are also on the market. It is believed, however, that the latter are gradually decreasing, as the home article is fully able to compete both in quality and price. A certain number of ploughs are also manufactured in Siberia for use in the country. A few sets of tractors and ploughs have been sold to large estate owners during the past year, one of the sets being British and the rest American; the Vice-Consul is of opinion that this will be an increasing business in the future. (*Board of Trade Journal*, September 26th, 1912.)

Notes on the Weather in September.

During the last week in August the general condition was very unsettled. Rain fell on most days, but varied greatly in quantity in the different districts. Temperature continued below the normal, the deficit amounting to as much as 4½° in Scotland E. and 4° in Scotland N. Rainfall was above the average except in Scotland N., but in England N.W. and Scotland E. the excess was very slight. In England E. the fall amounted to more than seven times as much as the average, the heaviest fall being recorded at Norwich, where 6 in. was collected between 4 a.m. and 3.15 p.m. on August 26th. Bright sunshine was everywhere below the normal.

As a whole, the conditions were much drier in the *first* week of September (September 1st to September 7th) than in previous weeks, and also less cloudy, but rain fell on most days in the West and North. In the south and south-east of England the greater part of the week was dry. Temperature continued below the average, the deficit being greatest in England S.E. and Scotland E. Rainfall was below the average in all parts of England except the north-west, but in Scotland there was a large excess. Bright sunshine was below the average in all districts.

In the *second* week the weather was mostly dry, although seldom bright, but in the north-east and east of Great Britain rain was again experienced early in the week. Warmth was classed as "very deficient" in all districts. Rainfall was "light" except in England N.E., where it was "moderate," and England E. and Scotland E., where it was "heavy." Bright sunshine was "scanty" or "very scanty" throughout all English districts.

During the *third* week the weather was rainless over nearly the whole of Great Britain, and in many districts the atmosphere was brighter than during the preceding weeks. Temperature was again below the normal except in the north and east of Scotland. Bright sunshine was below the normal over the eastern half of the country, but above it in the western section.

The weather continued fair to fine over Great Britain as a whole during the *fourth* week. Temperature continued below the average, the deficit amounting to 4° in England S.E. Rainfall was again less than the normal in all districts. Over the country generally the fall was less than 0·1 in., and over practically the whole of Scotland the week was rainless. Bright sunshine exceeded the normal, except in Scotland W., the excess being large in England S.E. and Scotland N.

Acreage of Hops.

THE Board of Agriculture and Fisheries have issued the following preliminary statement, dated September 6th, compiled from the Returns collected on the 4th June, 1912, showing the acreage under hops in each county of England in which hops were grown, with a comparative statement for the years 1911 and 1910.

COUNTIES, &c.		1912.	1911.	1910.
		Acres.	Acres.	Acres.
KENT	East	5,993	5,718	5,779
	Mid...	7,380	6,966	6,942
	Weald	8,077	7,507	7,357
	Total, Kent	21,400	20,191	20,078
GLOUCESTER		30	29	31
HANTS		1,516	1,444	1,411
HEREFORD		5,236	5,034	4,987
SALOP		103	99	103
SURREY...		513	500	514
SUSSEX		2,847	2,698	2,653
WORCESTER...		3,186	3,061	3,109
TOTAL		34,831	33,056	32,886

Agricultural Conditions in England and Wales on October 1st.

The reports furnished by the crop reporters of the Board on agricultural conditions in England and Wales state that the fine and dry weather which had generally prevailed after the first week of September had enabled good progress to be made in harvesting the corn. In the south and midlands practically all had been secured by the end of the month; but in the north some still remained out. In some parts of the country labour seems to have been hardly sufficient.

Potato-lifting had generally commenced, but very little progress had been made with the main crop, although work was more advanced in the south. In a few districts the tubers, although everywhere small, proved sounder than was expected; but these are not the majority, as disease generally made further progress during the month, and in many counties the crop is very bad. The yield throughout England and Wales is expected to be about 87 per cent. of an average.

Roots are mostly healthy, but the cool weather has been all against progress, and they are still very small, so that prospects are now for only a poor crop. In a few districts mention is made of mildew; and in some districts also there are good crops, more particularly in the midlands and south-east. Turnips and swedes are now expected to yield about 6 per cent. below average, while a deficiency of some 3 per cent. is looked for in mangolds.

A great deal of hay was made during September, much of it being the first cut. This, combined with the late corn harvest, prevented autumn cultivation generally, and ploughing is very backward almost everywhere. The land is now generally in good condition for these operations, except where the long spell of dry weather has made it too hard.

"Seeds" are everywhere very thick and luxuriant, and are frequently stated to have grown as tall as the corn.

Pastures are, throughout most of the country, very full, although the quality of the grass is unsatisfactory.

In some parts they are said to be getting bare. Live stock have done much better than in August, and are generally thriving.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for September, 1912, issued by the International Institute of Agriculture, contains official information received up to September 18th. In *Germany* the cereal harvest was retarded by cold and rainy weather. Wheat cutting had not been finished at the beginning of September, and there had been some sprouting. The rye and barley harvests, on the contrary, are ended, and have suffered much less; oats have suffered most. In *Austria,* wheat and rye were harvested. August was cold and wet throughout the whole of *Canada.* Ripening was consequently delayed, and the harvest is late. Grain in Ontario had been cut at the end of August, but rain hindered work, and there are complaints of sprouting. The condition in the north-west is excellent, but warm weather is required for ripening and harvesting. Wheat cutting is general in Manitoba, and is commencing in other parts of the west.

Forecasts of Total Production.—Estimates for France, Roumania, Norway, and the Netherlands have been added this month, and revised estimates obtained for Italy, Canada, and the United States. No figures have yet been received from Scotland, Ireland, the German States other than Prussia, and Sweden. The total production of wheat in those countries of the northern hemisphere from which estimates have been received is now estimated at 399,774,000 qr., an increase of 6·7 per cent. compared with that of last year; that of barley at 140,922,000 qr., an increase of 5·7 per cent.; that of oats at 359,176,000 qr., an increase of 17·8 per cent.; and that of rye at 185,116,000 qr., an increase of 17·7 per cent. The production of wheat in France is placed at 41,868,000 qr., an increase of 3·8 per cent., and that of rye at 5,987,000 qr., an increase of 8·1 per cent. The estimates of wheat in Roumania and India (the latter of which may be taken as final) are 11,174,000 qr., a decrease of 6·5 per cent., and 45,853,384 qr., a decrease of 2·1 per cent.

Estimates of the production of maize in Bulgaria, Spain, Hungary Italy, Roumania, Russia, Switzerland, United States, Japan, and Egypt are now available. The total production of these countries is placed at 421,756,000 qr., an increase of 17 per cent. compared with that of last year. The principal increases are 80·2 per cent. in Bulgaria, the production this year being 6,428,000 qr.; 39·3 per cent. in Hungary, the production being 22,322,000 qr.; 18·3 per cent. in the United States, the production being 349,316,000 qr.; and 3·4 per cent. in Italy, where the production was 10,836,000 qr. The principal decrease, of 25·2 per cent., occurs in Russia, where the production is estimated at 7,221,000 qr. There is also a decrease of 3·9 per cent. in Roumania, the production being 13,258,000 qr.

Southern Hemisphere.—The area sown with autumn wheat in Australia this year is estimated at 7,745,920 acres, an increase of 4·1 per cent. over that in 1911. The condition of the crop on September 1st was good. In New Zealand the condition of winter cereals on the same date was average. The sowing of spring wheat and oats began under fairly good conditions. Barley sowings have not yet commenced.

Sugar Beet.—The production in Belgium is estimated at 2,013,118 tons, an increase of 38·6 per cent. compared with that of last year; in Bulgaria at 44,277 tons, a decrease of 27·4 per cent.; in Denmark at 519,410 tons, a decrease of 27·7 per cent.; in Spain at 1,061,633 tons, an increase of 23·3 per cent.; and in Roumania at 295,179 tons, an increase of 14·0 per cent. The condition of the crop in Austria is good, and excellent crops will be obtained in many districts of Hungary.

Germany.—The usual official crop report states that the potato crop is better than was expected. It is, however, frequently complained that the tubers are small, and that the gluten contents are somewhat unsatisfactory. The yield is likely to be about an average. Despite repeated interruptions and rather heavy frosts, autumn cultivation has made good progress. Rye drilling is considerably advanced, and even completed in some districts, but germination is very slow. Very little wheat is yet sown. (Dornbusch, October 7th.)

Hungary.—According to the official report of September 9th, the production of potatoes this year is estimated at 5,118,000 tons, compared with 4,366,000 tons in 1911.

Holland.—The official report of the Dutch Ministry of Agriculture giving the condition of the crops on September 12th, stated that good financial results were to be expected from this year's crops. Rye and barley had produced good crops, of which by far the greater part was secured in good condition. Potatoes (414,960 acres), of which very few had been lifted, had certainly suffered in quality, but the yield would probably be very good; this can also be said of onions. The yield of sugar beet (155,510 acres) would probably be under the average. Root crops and clover were normal. Wheat, oats, peas, and beans had suffered considerably from unfavourable weather, especially in North and South Holland and in Zeeland. The second crop of hay was very poor. A storm on August 26th did considerable damage in the fruit-growing districts; on the whole, however, the fruit crop, although not so abundant as was at first expected, promised to be satisfactory. (H.M. Consul at Amsterdam.)

Spain.—H.M. Consul at Corunna, in a report dated September 4th, stated that the apple crops were a complete failure, but that the hazel nut crops would be very good.

Russia.—H.M. Consul at Odessa, reporting on October 4th, states that in south-west Russia continual rain since the corn was cut has hindered threshing and caused the grain to sprout. Large quantities are still in the fields. The harvest as a whole appears to be below the average both in quantity and quality. Barley is very discoloured, and it is said that there will be very little good enough to export for brewing purposes. It is feared that very little of the maize crop will ripen properly, and that most of it will only be fit for fodder.

A report from the same source, dated September 25th, states that this year's hay crop in European Russia was a great success. Nearly 60 per cent. of the hay-producing area yielded good results as regards both quantity and quality, 20 per cent. was satisfactory, while only 20 per cent. was unsatisfactory or bad.

United States.—The Bureau of Statistics of the U.S. Department of Agriculture on October 1st estimated the yield of the corn crops as follows:—Winter wheat, 390,000,000 bush., compared with 430,656,000 bush. in 1911; spring wheat, 330,391,000 bush., compared with 190,682,000 bush. in 1911; barley, 224,619,000 bush., compared with 160,240,000 bush. in 1911; and oats, 1,417,172,000 bush., compared with 922,298,000 bush. last year. The average condition of potatoes was 85·1, compared with 76·2, the average of the last ten years. (*Dornbusch*, October 9.)

Australia.—The *Monthly Summary of Australian Statistics* of June, 1912, issued by the Commonwealth Bureau of Census and Statistics, gives the following estimates of the production of the principal crops in the Commonwealth in the season 1911–12:—Wheat, 71,664,971 bush., a decrease of 25 per cent. as compared with the previous season; oats, 9,548,456 bush., a decrease of 38 per cent.; maize, 8,912,113 bush., a decrease of 32 per cent.; and hay, 2,868,016 tons, a decrease of 10 per cent.

Hops.—Messrs. John Barth and Son, of Nuremberg, in their report on the hop crop and prices, dated September 28th, estimate the world's production of hops this year at 1,741,000 cwt., as compared with 1,326,000 cwt. in 1911, and 1,542,000 cwt. in 1910. They estimate the yields in the various hop-growing countries as follows: Germany 399,000 cwt., Austria-Hungary 372,000 cwt., Holland and Belgium 69,000 cwt., France 59,000 cwt., Russia 66,000 cwt., England 341,000 cwt., America 421,000 cwt., and Australia 14,000 cwt. This year's world average yield per acre of 7·3 cwt. is to be counted, they consider, among the record yields of the last thirty years, and has only been exceeded in 1894, 1899, and 1905. The quality, however, leaves much to be desired. The cones are generally small, spotted, and, to a great extent, yellowish in colour.

Year-book of Agricultural Statistics.

The International Institute of Agriculture has just published in French its first International Yearbook of Agricultural Statistics (Annuaire international de statistique agricole, 1910), which is a collection of statistical tables systematically grouped, and containing figures of area and production of the principal crops and the numbers of live stock, during the decennial period 1901–1910, in the countries adhering to the Institute, which are now 50 in number, and include almost the whole of the civilised world.

The scope of this yearbook is twofold: in the first place, it shows what progress has been made up to the present time in the organisation of agricultural statistics, and, secondly, gives the results obtained from such statistics. The tables show the area and production of a number of crops, and the years for which figures exist. Figures for all countries are expressed in the same measures, and grouped into concise and intelligible tables so as to enable the reader to form an opinion of the evolution of agriculture either in individual countries or in the whole group of countries adhering to the Institute.

The Volume may be obtained from the Board of Agriculture and Fisheries, 8 Whitehall Place, London, S.W., price 4*s.* 2*d.* post free.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on October 1st, 1912, certain diseases of animals existed in the countries specified:—

Austria (for the period September 11th—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 914 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period August 1st—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (3 "foyers" in 3 "communes"), Glanders and Farcy, Rabies.

Bulgaria (for the period September 6th—14th).

Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Swine Fever.

Denmark (month of August).

Anthrax, Swine Erysipelas.

France (month of July).

Anthrax, Blackleg, Foot-and-Mouth Disease (2,426 "étables" in 635 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period September 1st—15th).

Foot-and-Mouth Disease (102 infected places in 28 parishes), Glanders and Farcy, Swine Fever.

Holland (month of August).

Anthrax, Foot-and-Mouth Disease (3 outbreaks in 3 provinces), Foot-rot, Swine Erysipelas.

Hungary (for the period September 4th—12th).

Anthrax, Foot-and-Mouth Disease (total of 77 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period September 2nd—8th).

Anthrax, Blackleg, Foot-and-Mouth Disease (30 new cases entailing 1239 animals), Glanders and Farcy, Rabies, Swine Fever.

Montenegro (for the period June 15th—July 1st).

Glanders and Farcy.

Norway (month of August).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period September 4th—13th).

Anthrax, Dourine, Glanders, and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of May).

Anthrax, Foot-and-Mouth Disease (3,277 animals in 95 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period August 3rd—10th).

Anthrax, Sheep-pox.

Spain (month of July).

Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (56,470 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheepscab, Swine Erysipelas, Tuberculosis.

Sweden (month of August).

Anthrax, Blackleg.

Switzerland (for the period September 16th—22nd).

Anthrax, Blackleg, Foot-and-Mouth Disease (163 "étables" and "pâturages" entailing 2,978 animals, of which 38 "étables" and "pâturages" were declared infected during the period), Swine Fever.

Agricultural Labour in England during September.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in September:—

Agricultural labourers were generally well employed during the fine weather which prevailed in September, many farmers having arrears to clear up in consequence of the rain in the previous month. Labourers outside the regular farm staff were in good demand in most districts, though some lost a little time through rain in the early part of the month. An insufficient supply of such extra men was reported in a few districts, and some scarcity of hop- and fruit-pickers was reported in several of the hop- and fruit-growing districts.

Northern Counties.—There was a good demand for extra labourers in these counties for the corn harvest, and in many districts for finishing the haymaking. The supply of such men was usually sufficient, but some scarcity was reported in several districts in *Cumberland* and also in the Glendale (*Northumberland*) and Pickering and Pocklington (*Yorkshire*) rural districts. Harvesting operations were somewhat interrupted by rain in the first week of the month.

Midland Counties.—Extra labourers lost some time through rain in the early part of the month, but were afterwards in good demand. There was an insufficient supply of men in parts of the Bucklow and Macclesfield (*Cheshire*), Blore Heath, Cannock, and Leek (*Staffordshire*), and Bedford and Eaton Socon (*Bedfordshire*) rural districts, while a scarcity of fruit- and hop-pickers was reported in several districts in *Worcestershire*. More men for permanent situations were wanted in the Daventry and Wellingborough (*Northamptonshire*), Banbury (*Oxfordshire*), and Wycombe (*Buckinghamshire*) rural districts.

Eastern Counties.—The corn harvest and other work, such as threshing, carting and spreading manure, and trimming hedges, provided a good deal of employment for extra labourers in these counties. The supply of such men was usually about equal to the demand, though some excess was reported in the Swaffham (*Norfolk*) rural district. A scarcity of men for permanent situations was reported in the Aylsham (*Norfolk*) rural district.

Southern and South Western Counties.—Apart from a few wet days in the early part of the month, extra labourers were generally in full and regular employment in these counties, their principal work, besides the corn harvest, being haymaking, hoeing, lifting potatoes, trimming hedges, carting manure, and threshing. Some scarcity of men was reported in parts of the Godstone (*Surrey*), Hartley Wintney (*Hampshire*), Bridgwater (*Somerset*), Thornbury (*Gloucestershire*), Torrington (*Devonshire*), and West Penwith (*Cornwall*) rural districts, while there was some scarcity of hop-pickers in several districts in *Kent* and *Herefordshire*. A surplus of extra men was reported in the Epsom (*Surrey*)

and Westbury (*Wiltshire*) rural districts. There was a scarcity of men for permanent situations in several districts, including the Maidstone (*Kent*), Godstone (*Surrey*), Andover (*Hampshire*), Dursley and Stow-on-the-Wold (*Gloucestershire*), and Axminster and Newton Abbot (*Devonshire*) rural districts.

THE CORN MARKETS IN SEPTEMBER.

C. KAINS-JACKSON

Wheat.—Dry weather during the greater portion of September helped in the first place in the completion of harvest under circumstances much more advantageous than those of the opening. In the second place, the condition of grain in stack was improved by drying winds, and before the month was out samples were showing a general improvement. At the same time, the very serious injury done by the almost unbroken bad weather of August left its mark only too unmistakably on the local averages, which, in the Fen country, and in parts of Yorkshire, fell below 30*s.* per quarter. Mark Lane attracted a fair supply of new wheat rather above the average quality, and the mean price for the month in London was about 3*s.* above that for September, 1911. The last few days' trade was marked by a rather good inquiry for seed corn, for which 40*s.* and over was paid Imported wheat did not decline to any appreciable extent for delivery out of the granaried stocks, which at fifteen ports at the end of the month did not exceed two million quarters, and were not therefore felt as at all oppressive. Owing to the delay in harvesting and the unfitness of much of the new grain for immediate threshing, food requirements for September had to be satisfied out of warehoused stocks to a much greater extent than usual. This gradually relieved the situation at the ports, and made them steadier markets than many of the agricultural exchanges. The discouraging fact for holders at the end of September was the willingness of substantial firms to sell for November and December delivery at prices 1*s.* to 1*s.* 6*d.* per qr. under spot values. This rendered October values precarious. American futures, both for winter and spring wheat, were fully 1*s.* per qr. cheaper on the month, and closed at 37*s.* 6*d.* for No. 1 Duluth, 37*s.* for No. 2 Hard Winter, and 36*s.* for ordinary Red Winter, all for November delivery. There are no excessive supplies on passage, but steamers get over from America in a fortnight. Meanwhile Canada, though delayed in harvesting by rains in early September, was offering by the 30th new crop at 37*s.* 9*d.* for finest, 35*s.* 3*d.* for No. 3, and at proportionately lower prices for lower grades. The situation was therefore one of some embarrassment, for the buyer did not feel justified in depending upon the usual large October deliveries of farmers, and the seller was obviously menaced by the new crops moving towards our shores from oversea. September shipments were 1,483,000 qr. from North America, 449,000 qr. from South America, 1,078,000 qr. from Russia, 963,000 qr. from Europe S.E., 871,000 qr. from India, and 362,000 qr. from Australasia. North America, while a somewhat freer shipper than last year, did not augment her exports to the extent which the new harvest had led operators to anticipate. Good reports of the growing crops in Australia and Argentina were current in London at the close of the month, and somewhat increased holders' willingness to sell. A dear wheat market at Paris, contrasted with crop estimates in excess of expectation, added to the perplexities of the market situation. The supply on passage on the 30th was 2,140,000 qr., including 800,000 qr. Indian, 360,000 qr. Australasian, 280,000 qr. Argentine, 220,000 qr. Russian, and 390,000 qr. from Canada and the United States.

Flour.—Very fine weather for the week of the Bakers' Exhibition brought an unusual number of visitors to town. London millers made certain timely concessions to secure forward business for the last three months of 1912, and the occasion on the whole may be regarded as a successful one. The trade, as usual, in the fortnight following the show week, was very quiet, but the increased offers of country flour, which of themselves might have caused some decline at Mark Lane, were balanced in effect by the very small shipments from America. The quantity on passage from the New World fell by 39,000 sacks on the month, and the grand total on the 30th stood at 149,000 sacks only, for all sorts. Prices ruling were 26*s.* for Country Roller Whites, 27*s.* for American Bakers', 28*s.* for Town Households, 28*s.* 6*d.* for Standard, for Iron Duke, and for Australian, 30*s.* for fine American and Canadian, 31*s.* for Town Whites, 33*s.* for London best, 34*s.* for London-made by Hungarian process, and 38*s.* for finest Hungarian.

Barley.—An unusually wide range in the averages for British barley has been disclosed. It is the natural result of the very diverse experiences of different districts during harvest. Towards the end of the month the percentage of fairly fit brewing samples appeared to be increasing. Russia made a great shipping effort, and sent off 2,064,000 qr. during the month. The effect on prices was confined to the commoner feeding kinds, which Russia alone grows, but on this branch of the market a good deal of depression was the natural result. On the 30th Russian barley on passage and due by mid-October was offered at 25*s.* per 400 lb., whereas on August 31st 29*s.* 6*d.* was the price ex warehouse. For October shipments 24*s.* 6*d.* was accepted, and Russia's energy in shipping her new crop may be reckoned as having altered feeding barley prices by 5*s.* in two months. On the 30th there were 705,000 qr. on passage, a notable increase on the month. The other shippers besides Russia were California, 51,000 qr., Europe S.E., 276,000 qr., and India, 200,000 qr. The Brewers' Institution at Berlin puts reserves of malt at 3,500,000 qr. (336 lb.), a high total; none the less, German and Austrian malting barley is not at all depressed, but is held for high prices—42*s.* to 44*s.* per 448 lb. delivered in London.

Oats.—Value for the new home crops has not declined, as many expected, and at all the larger markets there has been an adequate choice of fair to good samples. It appears to be generally agreed that the new crop is small, but market opinion inclined to the idea that it took less damage for the season than either wheat or barley. The number of exchanges quoting over a twenty-shilling average must be deemed satisfactory. Imported oats have changed very little in price on the month, but America and Russia are accepting somewhat reduced rates for November shipment of their new crops. Shipments for September were 441,000 qr. from North America, 253,000 qr. from South America, 215,000 qr. from Russia, and 5,000 qr. from New Zealand. There were 390,000 qr. on passage on the last day of the month.

Maize.—Argentina has now completely dominated this trade for four months, and September shipments, which amounted to 2,904,000 qr., were larger than for any month except August, with its 3,509,000 qr. record. The price of Argentine maize landed was 28*s.* in the first half of September, 27*s.* 6*d.* in the second half, and 27*s.* was the price on the 30th, for which early October delivery could be secured. Owners of cargoes due during October were offering to deliver early in November at 26*s.* per 480 lb. The United States are seldom backward where speculation is concerned, and the new crop, being a rather good one, offers to ship in January at 24*s.* were forthcoming before September was out. The grain takes two months to dry, and January 1st has long been the conventional opening date of trade for actual delivery of the new crop. September shipments from countries other than Argentina were :—Russia, 134,000 qr., and Europe S.E., 101,000 qr. The shipments from South Africa, East Africa, and Burma were insignificant. The supply on passage—1,400,000 qr.—is one of the largest ever recorded.

Oilseeds.—Linseed shipments for September were only 107,000 qr. from South America and 154,000 qr. from India, so that the total on passage had fallen by the 30th to 110,000 qr. In ordinary circumstances prices must have advanced, but exceptionally large crops being officially reported from both the United States and Canada, the markets have not been at all good. On spot 57*s.* for Argentine, 62*s.* for Indian, and 70*s.* for English and fine Russian, have been ruling prices, but the new American crop is expected to control the markets in November and December. Fine quality and weight are both indicated, and 57*s.* 6*d.* for 424 lb. is mentioned as a probable opening price. There seems to be no hurry of the New World to put its new linseed on the British market. Cottonseed continues to make 9*s.* per cwt. on spot for Egyptian, but the new crop is offered for November shipment, Alexandria to London, at 8*s.* 9*d.* per cwt., cost, freight, and insurance.

Various.—Beet sugar has made 12*s.* per cwt. on spot, but new crop for future delivery is at 10*s.* per cwt. Buckwheat and rye are steady at about 31*s.* per qr. Milling offals are 5*s.* to 7*s.* 6*d.* per ton cheaper on the month. Some new blue peas are offering at 80*s.* per qr. Fine winter tares are in request for sowing, and 88*s.* is paid for dry and fit samples. Opening prices for the new mustardseed were about 10s. per bushel.

THE LIVE AND DEAD MEAT TRADE IN SEPTEMBER

A. T. MATTHEWS.

Fat Cattle.—The influences at work in August affecting the prices of cattle as quoted at market have been more pronounced in September. Really good ripe cattle became very scarce, and those on offer have been of smaller value intrinsically. That is to say, they cost the butcher more in what is called "waste." This depreciation is quite normal, and always occurs during the autumn months. If anything, it has been smaller than usual this September, the pastures having been full of grass. Still, there has been an appreciable falling off, and this, in the writer's opinion, has been quite sufficient to account for the reduction in apparent average prices which has taken place. This explanation is borne out by the following facts: It was mentioned last month that good prices had been maintained at Ipswich for prime, ripe, stall-fed cattle. Such cattle have continued to command undiminished rates—that is, 10*s.* per 14 lb. stone, while the best class of Shorthorns at London and other markets have declined considerably, and now only make 8*s.* 9*d.* The following are the average prices of the various breeds in English markets for September: Shorthorns, 8*s.* 10*d.* and 8*s.* per stone, for first and second quality, against 9*s.* 3*d.* and 8*s.* 3*d.* in August; Herefords, 9*s.* and 8*s.* 2*d.* against 9*s.* 5*d.* and 8*s.* 8*d.*; Devons, 8*s.* 10*d.* and 7*s.* 11*d.* against 9*s.* 3*d.* and 8*s.* 2*d.*; Welsh Runts, 8*s.* 9*d.* and 8*s.* 1*d.* against 9*s.* and 8*s.* 3*d.*; Polled Scots, 9*s.* 1*d.* and 8*s.* 11*d.* against 9*s.* 8*d.* and 9*s.* per stone. Prices generally have thus declined fully ¼*d.* per lb. during the month.

Veal Calves.—A steady, normal trade for fat calves prevailed throughout the month, and the averages were again 8¼*d.* and 7½*d.* per lb. in 25 markets of England and Scotland. It should be noted that these prices do not include the lowest class of animals, some of which are sold at as little as 4*d.* per lb. Thousands of others are sold at a day or two old, which do not appear at market.

Fat Sheep.—Sheep values have tended downwards, but the decline from those of August was very small, being less than a farthing per lb. on the average of about 20 English markets. Those classed as "Downs" averaged 8¾*d.*, 7¾*d.*, and 6*d.* for the three qualities, and Longwools 8¼*d.*, 7½*d.*, and 5½*d.* per lb. Though these prices show a decline from the highest point, they are still about 1*d.* per lb. higher than those current a year ago. The good prices obtainable in the Scotch markets have deprived Islington of its supplies of Scotch sheep, the fine quality and handy weights of which render them so popular with suburban butchers. A few Southdowns appear there at irregular intervals, but there is no doubt that the London market is very badly supplied with those small sheep for which there is a constant and excellent demand.

Fat Lambs.—There was a marked falling off in the supply of lambs, but it was quite equal to the demand, as the season is drawing rapidly to a close. Those sent to market are grass-fed, and scarcely exceed small mutton in value per lb. In the week ending September 25th they were quoted in 30 British markets, and their average price was 9*d*. and 8*d*. per lb. against 9½*d*. and 8½*d*. in August. In that week they were quoted at 10*d*. at Ashford (Kent), which was their highest market. At Liverpool and several other places the top price was 8½*d*.

Fat Pigs.—Bacon pigs and also porkers have been in good request, and prices have again tended upwards. The averages for bacon pigs in September were 7*s*. 9*d*. per stone for prime small, and 7*s*. 1*d*. for larger pigs against 7*s*. 5*d*. and 6*s*. 10*d*. in August. The market is very bare of English bacon, and prices are about 1*s*. 3*d*. per stone higher than they were a year ago.

Carcass Beef—British.—Scotch beef has been in poor supply at Smithfield, and nearly all of it has been in the form of short sides. On many days there were no long sides at all, and the quantity of English (except cow-beef) was almost nominal. Irish has arrived in considerable bulk. Some of it was very good in quality, but much was poorly fed. The average price of Scotch was 5*s*. 2*d*. and 4*s*. 11*d*. per 8 lb. for short, and 4*s*. 9*d*. and 4*s*. 6*d*. for long sides, the latter being 3*d*. per stone lower than in August. The Irish beef is now selling at 3*s*. 9*d*. to 4*s*. 1*d*. according to quality.

Port-Killed Beef.—Extremely little American beef killed at Deptford or Birkenhead has arrived, and the trade in this article is considered nearly at an end. The average price of that on offer was 4*s*. 1*d*. and 3*s*. 11*d*. per stone for first and second quality.

Chilled Beef.—Argentine chilled quarters have been only moderately supplied, and have sold at the uniform rates for hinds of 3*s*. 6*d*. and 3*s*. 2*d*. since the first week, when the top price was 2*s*. 10*d*. The trade was much steadier than in August. Forequarters were comparatively high in price after the rise in the second week, the best making 2*s*. 6*d*. per stone.

Frozen Beef.—There was no notable feature in the frozen trade, the best Argentine hinds making about 2*s*. 9*d*. per stone, and fores 2*s*. to 2*s*. 2*d*. New Zealand produce fetched the same, and Australian about 1*d*. per 8 lb. less money. The threatened competition of the Continent for foreign meat is giving rise to much discussion, and it is expected that much higher prices would result if the trade should develop.

Carcass Mutton—Fresh Killed.—All descriptions of fresh mutton declined in value, and the trade was at times exceedingly sluggish, especially about the middle of the month, when the primest small Scotch was only worth 4*s*. 8*d*. per 8 lb. Averages were 4*s*. 11*d*. and 4*s*. 7*d*. for Scotch; 4*s*. 6*d*. and 4*s*. 1*d*. for English; and 4*s*. 1*d*. and 4*s*. for Dutch.

British Lamb.—The demand for lamb was small, and the price low for British. For the first two weeks the average was 5*s*. and 4*s*. 8*d*. for prime and second quality respectively, falling to 4*s*. 8*d*. and 4*s*. 4*d*. in the latter half of the month.

Frozen Mutton and Lamb.—Unlike the fresh killed, the frozen trade has been very good, with prices rather higher for mutton. New Zealand especially has been firmly held, and towards the end of the month was quoted at 3*s*. 4*d*. per stone. Very little Australian has been offered, and Argentine best quality has made 3*s*. per stone. Frozen New Zealand lamb was steady, and averaged about 4*s*. 1*d*. for best quality.

Veal.—Prime veal has been scarce and rather dear, fetching 5*s.* 4*d.* and occasionally 5*s.* 8*d.* per stone, but inferior quality was hard to move at any price.

Pork.—The cold weather helped the trade, but supplies were very moderate and scarcely equal to the demand. English pigs began at 4*s.* 8*d.* to 4*s.* 4*d.*, but advanced to 5*s.* 4*d.* and 5*s.* for first and second quality. Dutch pork was nearly as dear as English.

THE PROVISION TRADE IN SEPTEMBER.

HEDLEY STEVENS.

Bacon.—Trade in this article has again been quiet on the whole, and prices showed little change until towards the end of the month, when there was a general firming up owing to smaller supplies from most sources, with a prospect of such conditions lasting for some weeks at any rate. At the enhanced figures now asked, prices—which were already much above last year—are brought to a very high level, and it is feared by some that the effect will be a still smaller consumption, especially as the best of the season is now over.

Danish arrived in small quantities during the month, but it was thought that the shortage could be accounted for by the fact that most of the farmers would be busy harvesting. However, at the time of writing it is reported that the harvest in that country is finished, but there is still no material increase in the shipments. The arrivals from Canada have been smaller, and at the end of the month there was a marked falling off, the latest advices being to the effect that all the packing houses are going very slowly, as with the present price of pigs in that country their product is being sold at a loss on the British markets.

All cuts of American bacon and hams were also in much shorter supply. Merchants have not been contracting to any extent in these goods of late, as, owing to the poor trade during the past two or three months, principally on account of the unseasonable weather, they have had to put by a large part of their arrivals in cold store, and are still drawing on these stocks. The American packers have not been tempted to ship on consignment either, as, although prices in this country now appear very high, they do not show any profit against the high prices which are being paid for the raw material in the United States. The value of hogs at Chicago ranged during the month from $7.70 to $9.20, against $5.85 to $7.55 during September of last year, and $8.25 to $9.90 in 1910.

English curers have in some cases found the supplies of pigs to be rather more free, but no material increase is looked for.

Cheese.—During the month there has been a set-back of several shillings per cwt. in the c.i.f. values of Canadian cheese, which, as mentioned in last month's review, had reached as high as 67*s.* 6*d.*, a point above the ruling price last year, when there was a drought in practically every cheese-making country. This drop has been brought about chiefly by the determination of most importers of this product not to pay the high figures demanded in the face of the larger stocks on all hands, and the big make which is going on in this country. There is also every possibility of a large autumn make in Canada, as the following extract from a recent issue of the *Montreal Trade Bulletin* shows: "The prospects are in favour of a large fall make of cheese, advices from the Belleville and Brockville sections indicating an increased production, a letter from the latter section stating that the last week of August make in twelve factories showed an increase of 15 per cent. Advices from St. Paschal, P.Q., also stated that the make of cheese was increasing. The present season is far more propitious for the production of cheese than a year ago, when the make suffered a shortage from drought."

The stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 48,000 in excess of the same time last year, the quantity being 317,000 boxes, against 269,000 at the end of September, 1911, and 363,000 in 1910.

The New Zealand factory-men are still demanding very high prices for their outputs during the coming season, and a certain quantity has been sold, although the majority of importers are of the opinion that they will do better by waiting until the cheese is actually arriving on our shores. It is reported in some quarters that the increase in the make of New Zealand cheese this season will amount to somewhere between 10,000 and 12,000 tons, but of course a great deal will depend on the climatic conditions. It is expected that more cheese will be shipped from Australia also this season.

A fair trade has passed in the home make, but prices have been irregular on account of the uneven quality caused by the wet season. Best lots are, however, being held for higher prices.

Butter.—This article has experienced a poor "hand-to-mouth" demand throughout the month, with prices irregular. Secondary butter especially has been very difficult to sell, best quality meeting with a little better attention. As a result, Irish creameries show a fair rise on the month, whereas factories remain unchanged. It is anticipated that the market will drag along under these conditions for some weeks—in fact, until the new season's Colonial starts arriving.

There are still no shipments to this country from Canada or the United States, and in the case of the former country a record is constituted by the fact that nothing has yet been shipped this season. Some importers are making a "bull point" of this in connection with the high prices which the New Zealanders and Australians are still demanding for their outputs during the coming season. Their ideas are still at a price which is equivalent to 122*s.* and 124*s.* nett c.i.f. London, which importers are refusing to pay, although there have been a number of "short sales" made at, say, from 117*s.* to 119*s.* nett c.i.f. London.

Eggs.—Trade has been without animation, and prices of some descriptions rather tended downward until just at the close of the month, when a better tone prevailed for some sorts.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of September, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England.		Scotland.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
Fat Stock:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 1	8 11	46 6	41 5
Herefords	9 0	8 2	—	—
Shorthorns	8 10	8 0	45 1	40 8
Devons	8 10	7 11	—	—
	per lb.* d.	per lb.* d.	per lb.* d.	per lb.* d.
Veal Calves	8¼	7½	8¼	6¾
Sheep:—				
Downs	8½	7¾	—	—
Longwools	8¼	7¼	—	—
Cheviots	9	7½	8½	8
Blackfaced	8	7¾	8	7¼
Cross-breds	8½	7½	8¾	8
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	7 11	7 5	7 2	6 4
Porkers	8 1	7 8	7 9	6 10
Lean Stock:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	22 10	18 13	23 15	20 3
,, —Calvers... ...	23 3	19 12	21 9	18 5
Other Breeds—In Milk ...	19 11	16 12	22 6	17 17
,, —Calvers ...	17 10	16 5	22 1	18 6
Calves for Rearing	2 8	1 17	2 13	1 17
Store Cattle:—				
Shorthorns—Yearlings ...	10 18	9 0	12 13	10 7
,, —Two-year-olds...	14 18	12 16	17 17	14 12
,, —Three-year-olds	19 6	16 11	—	—
Polled Scots—Two-year-olds	—	—	19 15	16 9
Herefords— ,,	14 18	13 10	—	—
Devons— ,,	14 8	11 18	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	34 8	29 2	—	—
Scotch Cross-breds ...	—	—	27 1	23 3
Store Pigs:—				
8 to 10 weeks old	17 11	14 5	20 0	16 6
12 to 16 weeks old	28 8	21 8	—	—

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of September, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

'Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—							
English	1st	58 6	53 0	58 0	55 6	67 0*	67 6*
	2nd	53 6	49 0	54 6	52 0	59 6*	56 0*
Cow and Bull ...	1st	51 0	47 0	47 0	48 6	56 6	50 6
	2nd	43 6	39 6	42 6	43 6	50 0	43 6
U.S.A. and Canadian :—							
Port Killed ...	1st	—	—	57 0	—	—	—
	2nd	—	—	55 0	—	—	—
Argentine Frozen—							
Hind Quarters...	1st	37 6	38 0	37 0	38 0	38 6	37 6
Fore ,, ...	1st	30 6	29 6	30 6	29 6	30 0	30 6
Argentine Chilled—							
Hind Quarters...	1st	46 0	43 6	46 6	43 6	46 6	45 0
Fore ,, ...	1st	32 6	30 6	33 0	30 6	34 0	32 6
Australian Frozen—							
Hind Quarters...	1st	36 6	35 6	36 6	35 6	—	36 6
Fore ,, ...	1st	30 6	28 0	30 0	28 0	—	29 6
VEAL :—							
British	1st	—	73 0	75 0	68 0	—	69 0
	2nd	61 0	66 0	66 6	62 6	—	65 6
Foreign	1st	—	—	75 0	—	70 0	69 0
MUTTON :—							
Scotch	1st	—	67 6	69 0	67 6	66 0	72 6
	2nd	—	—	64 0	—	57 0	52 6
English	1st	65 6	62 6	63 0	66 0	—	—
	2nd	55 6	56 0	57 6	60 6	—	—
Argentine Frozen ...	1st	42 6	41 6	41 6	42 0	42 0	40 0
Australian ,, ...	1st	41 0	39 6	40 6	39 6	—	38 6
New Zealand ,, ...	1st	43 0	42 0	46 0	42 0	—	—
LAMB :—							
British	1st	66 6	65 6	67 6	67 0	67 6	71 6
	2nd	61 0	58 6	63 6	61 6	57 6	55 0
New Zealand ...	1st	58 6	56 0	57 6	56 0	—	56 0
Australian	1st	51 6	49 6	—	49 6	—	49 0
Argentine	1st	49 0	49 6	49 0	49 6	47 0	48 0
PORK :—							
British	1st	68 0	68 0	71 6	69 6	64 6	64 0
	2nd	63 6	62 0	67 0	64 0	56 6	62 0
Foreign	1st	—	—	71 0	—	—	—

Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6 ...	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
„ 13 ...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
„ 20 ...	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
„ 27 ...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3 ...	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
„ 10 ...	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
„ 17 ...	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
„ 24 ...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2 ...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
„ 9 ...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
„ 16 ...	32	6	30	1	34	0	23	6	24	11	31	2	18	0	17	6	21	8
„ 23 ...	32	9	30	2	34	1	23	7	25	0	31	10	17	11	17	5	21	9
„ 30 ...	33	0	30	3	34	4	23	8	24	11	30	3	18	0	17	5	21	8
Apl. 6 ...	33	6	30	4	34	10	23	1	24	7	30	9	17	11	17	7	21	11
„ 13 ...	33	7	30	3	35	4	23	5	25	2	30	2	18	3	18	3	22	1
„ 20 ...	33	7	30	4	36	7	23	0	25	5	29	11	18	3	17	10	22	4
„ 27 ...	33	0	30	11	37	10	22	10	25	5	30	4	18	3	18	3	22	9
May 4 ...	32	6	31	4	38	1	22	7	25	7	30	2	18	2	18	6	23	1
„ 11 ...	32	1	31	8	37	11	22	0	25	1	31	1	18	1	19	0	23	7
„ 18 ...	31	10	32	6	37	8	21	8	25	4	31	2	17	8	19	2	23	7
„ 25 ...	31	3	32	8	37	2	21	4	25	0	31	1	17	10	19	5	23	7
June 1 ...	30	2	32	5	36	10	21	8	24	10	30	0	17	10	19	5	23	9
„ 8 ...	29	1	32	4	36	11	20	9	25	7	29	11	17	10	19	7	24	0
„ 15 ...	29	0	32	3	37	0	18	11	23	11	30	8	18	0	19	8	23	10
„ 22 ...	29	4	31	11	37	5	20	1	23	9	30	8	17	9	19	10	24	0
„ 29 ...	29	9	31	10	37	10	19	11	24	5	30	2	17	7	19	9	23	11
July 6 ...	30	4	32	1	38	2	19	5	25	10	31	7	17	4	19	9	23	11
„ 13 ...	31	1	32	3	38	3	21	3	25	10	30	2	17	7	19	11	24	1
„ 20 ...	31	11	32	5	38	10	19	9	24	3	30	9	17	5	19	5	24	8
„ 27 ...	33	5	32	5	38	9	20	10	23	8	30	9	18	1	19	7	23	4
Aug. 3 ...	33	9	32	0	38	4	20	5	24	4	28	6	18	3	18	2	22	2
„ 10 ...	33	5	31	6	39	2	20	4	26	9	30	7	18	0	18	0	22	4
„ 17 ...	32	11	31	6	38	2	20	11	27	8	28	3	17	11	17	10	21	8
„ 24 ...	32	7	31	8	35	6	20	10	28	10	28	1	17	2	18	0	20	10
„ 31 ...	32	2	31	7	34	10	22	10	28	4	28	6	17	2	18	3	20	8
Sept. 7 ...	31	11	31	10	35	1	23	3	28	4	29	9	17	2	18	1	21	8
„ 14 ...	30	11	32	0	33	5	24	3	29	0	29	0	16	6	18	5	20	5
„ 21 ...	30	2	32	4	32	7	24	2	29	11	29	6	16	3	18	9	19	10
„ 28 ...	30	1	32	6	31	7	24	4	30	5	29	9	16	4	19	1	19	5
Oct. 5 ...	30	1	32	7	31	8	24	7	30	9	29	7	16	3	19	5	19	8
„ 12 ...	30	2	32	9			25	1	31	0			16	2	19	10		
„ 19 ...	30	4	32	9			25	3	31	5			16	1	19	11		
„ 26 ...	30	4	33	1			25	4	31	7			16	2	20	6		
Nov. 2 ...	30	4	33	4			25	6	31	10			16	2	20	8		
„ 9 ...	29	11	33	4			25	4	32	7			15	11	20	11		
„ 16 ...	29	8	33	1			25	1	32	10			16	1	21	0		
„ 23 ...	29	11	33	0			24	10	33	5			16	4	20	10		
„ 30 ...	30	6	32	10			24	7	33	10			16	7	20	11		
Dec. 7 ...	30	9	32	9			24	3	34	0			16	9	20	9		
„ 14 ...	30	7	32	11			23	9	33	5			16	10	20	9		
„ 21 ...	30	7	32	9			23	10	33	5			16	9	20	8		
„ 28 ...	30	5	33	0			23	9	33	4			16	9	20	7		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1911.	1912.	1911.	1912.	1911.	1912.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	August	42 4	48 1	26 4	30 3	21 9	23 8
	September	42 8	45 7	26 11	29 11	21 8	23 2
Paris:	August	43 4	48 0	26 3	30 10	22 11	24 5
	September	43 6	47 2	27 0	30 10	22 10	22 7
Belgium:	July	34 3	39 11	24 2	29 8	21 7	26 10
	August	33 8	36 5	25 4	28 10	20 10	25 3
Germany:	July	43 4	47 10	27 1	30 0	25 1	28 7
	August	42 4	44 8	30 6	31 0	23 1	24 6
Berlin:	July	45 8	48 11	—	—	23 2	26 0
	August	43 6	45 4	—	—	23 7	25 1
Breslau:	July	41 6	44 1	—* 24 9†	—* 30 1†	22 11	24 11
	August	39 7	41 6	29 10* 24 9†	31 2* 29 4†	22 11	25 9

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of September, 1911 and 1912.

—	WHEAT.		BARLEY.		OATS.	
	1911.	1912.	1911.	1912.	1911.	1912.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London...	33 3	36 4	29 7	30 3	20 0	21 7
Norwich	31 8	33 11	28 8	27 9	18 2	19 11
Peterborough	31 7	30 10	30 6	27 7	18 6	18 4
Lincoln...	32 0	32 0	29 9	28 11	18 8	21 10
Doncaster	32 0	34 0	27 9	25 11	18 3	22 2
Salisbury	31 5	35 3	27 8	30 1	18 3	21 4

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of September, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	13 6	12 3	—	—	14 3	13 0	15 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	118 0	115 0	119 0	115 6	119 6	117 6	119 0	—
,, Factory ...	108 0	102 0	107 6	100 6	107 0	101 0	—	—
Danish ...	—	—	131 0	127 6	129 6	127 6	126 6	—
French ...	—	—	—	—	120 0	116 0	—	—
Russian ...	110 0	105 0	109 6	106 6	110 0	107 0	107 6	—
Australian ...	114 6	110 6	—	—	116 6	114 6	—	—
New Zealand	—	—	—	—	—	—	—	—
Argentine ...	—	—	—	—	—	—	—	—
CHEESE :—								
British—								
Cheddar ...	75 6	72 0	74 0	71 6	76 0	70 0	71 6	69 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	73 6	68 6	76 6	70 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	67 0	64 6	67 0	65 0	67 0	66 0	67 0	—
BACON :—								
Irish	79 6	75 0	77 0	73 6	79 0	75 6	77 0	—
Canadian ...	72 0	70 0	70 6	68 0	73 0	71 0	73 6	71 6
HAMS :—								
Cumberland ...	—	—	—	—	103 0	99 0	—	—
Irish	—	—	—	—	98 0	94 0	105 0	103 0
American (long cut)	64 0	61 0	64 0	59 6	65 0	61 6	63 0	62 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	—	—	—	—	13 11	12 3	13 9	—
Irish	11 10	11 1	11 9	10 8	12 0	10 6	11 10	10 10
Danish ...	—	—	11 10	10 11	12 0	10 6	12 0	11 6
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
British Queen	91 0	78 6	76 6	71 6	90 0	82 6	—	—
Edward VII.	95 0	80 0	76 6	71 6	88 6	82 6	—	—
Up-to-Date ...	94 6	79 0	71 6	66 6	86 6	80 6	68 0	66 6
HAY :—								
Clover ...	95 0	80 0	120 0	102 6	129 0	101 0	79 6	72 6
Meadow ...	90 0	75 0	—	—	116 6	94 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	SEPTEMBER.		NINE MONTHS ENDED SEPTEMBER.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	28	64	594	648
Animals attacked	32	72	675	803
Foot-and-Mouth Disease :—				
Outbreaks	11	1	81	9
Animals attacked	187	16	599	441
Glanders (including Farcy) :—				
Outbreaks	16	21	138	153
Animals attacked	24	56	259	368
Parasitic Mange :—				
Outbreaks	76	—	2,422	—
Animals attacked	104	—	5,240	—
Sheep-Scab :—				
Outbreaks	4	4	177	311
Swine-Fever :—				
Outbreaks	127	153	2,345	1,921
Swine Slaughtered as diseased or exposed to infection ...	2,096	1,549	30,997	22,347

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	SEPTEMBER.		NINE MONTHS ENDED SEPTEMBER.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	—	—	3	7
Animals attacked	—	—	3	14
Foot-and-Mouth Disease :—				
Outbreaks	5	—	29	—
Animals attacked	25	—	261	—
Glanders (including Farcy) :—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	3
Parasitic Mange :—				
Outbreaks	1	2	52	52
Sheep-Scab :—				
Outbreaks	4	12	267	265
Swine-Fever :—				
Outbreaks	9	12	186	104
Swine Slaughtered as diseased or exposed to infection ...	35	186	1,509	1,765

ADDITIONS TO THE LIBRARY.

Plant Diseases.

Bryant, H. C.—The Relation of Birds to an Insect Outbreak in Northern California during the Spring and Summer of 1911. (195–208 pp.) [Reprinted from "The Condor," Vol. XIII., November, 1911.] [59.162 ; 63.27(04).]

Minnesota Agricultural Experiment Station.—Bull. 122 :—The Smuts of Grain Crops. (32 pp.) [63.24.] Bull. 123 :—Cutworms [Surface caterpillars], Army Worms, and Grasshoppers. (30 pp.) [63.27.] [Nineteenth Annual Report, 1910–11.]

Maine Agricultural Experiment Station.—Bull. 187 :—Insect Notes for 1910. (24 pp.) [63.27(02).] Bull. 189 :—Orchard Spraying Experiments. [63.294.] Bull. 190 :—*Macrosiphum Destructor* and *Macrosiphum Solanifolii.* (12 pp.) [63.27.] Bull. 194 :—Control of the Blackleg or Blackstem Disease of the Potato. (28 pp.) [63.24–33.] Bull. 195 :—Insect Notes for 1911. (20 pp.) [63.27(02).] Bull. 196 :—The Mycetophilidæ of North America. Part III. (80 pp.) [59.57.] [Twenty-second Annual Report, 1911.]

New York Agricultural Experiment Station.—Bull. 343 :—The Pear Thrips (*Euthrips pyri,* Daniel). (28 pp. + plates.) [63.27.] Bull. 344 :—The Grape Leaf-Hopper (*Typhlocyba comes,* Say) and its Control. (29–43 pp.) [63.27.] Bull. 347 :—A Comparative Test of Lime-Sulphur, Lead Benzoate and Bordeaux Mixture for Spraying Potatoes. (77–84 pp.) [63.24–33.] Bull. 348 :—Analyses of Materials sold as Insecticides and Fungicides. (85–98 pp.) [63.295.] Geneva, New York, 1912.

Pennsylvania Agricultural Experiment Station.—Bull. 115 :—Concentrated Lime-Sulphur Spray. (23 pp.) Centre County, Pennsylvania, 1912. [63.295.]

Eriksson, Jakob.—Fungoid Diseases of Agricultural Plants. (208 pp.) London : Baillière, Tindall and Cox, 1912. 7*s.* 6*d.* net. [63.24(02).]

Sanderson, E. Dwight.—Insect Pests of the Farm, Garden, and Orchard. (684 pp.) New York : John Wiley and Sons, 1912. $3.00. [63.27(02).]

Germany, K. Biologische Anstalt fur Land- und Forstwirtschaft.—Flugblatt Nr. 52 :—Die Kupferkalkbruhe, ihre Bereitung und Verwendung und andere kupferhaltige Pflanzenschutzmittel. (4 pp.) Berlin : Paul Parey, 1912. [63.295.]

Gussow, H. T.—Observations on the Parasitism of *Isaria farinosa* (Dicks.), Fr., with special reference to the Larch Sawfly (*Nematus erichsonii,* Hartig). (95–99 pp.) [Reprinted from the Transactions of the Royal Society of Canada. Third Series. 1910. Vol. IV., Section IV.] [63.27 ; 63.296.]

Ier Congrès International d'Entomologie, Bruxelles, 1910.—Vol. I. :—Historique et Procès-Verbaux. (276 pp.) Brussels, 1912. [59.57 ; 63.27(02).]

Tasmania Agricultural and Stock Department.—Bull. 24 :—Irish Blight (*Phytophthora infestans*). (19 pp.) Hobart, 1911. [63.24.]

Uruguay.—Defensa Agricola. Ley y Reglamentación. Exhortacion a los Hacendados y Agricultores des País. (36 pp.) Montevideo, 1912. [63.292(8).]

U.S. Dept. of Agriculture, Bureau of Entomology.—Circ. 152 :—The Rice Water-Weevil (*Lissorhoptrus simplex,* Say) and Methods for its Control. (20 pp.) Washington, 1912. [63.27.]

Live Stock—

Meysey-Thompson, R. F.—The Horse : Its Origin and Development combined with Stable Practice. (436 pp.) London : Edward Arnold, 1911. 15*s.* net. [63.61.]

Cornell Agricultural Experiment Station.—Bull. 304:—Substitutes for Skimmed Milk in Raising Calves, with Supplement showing Later Development. (32 pp.) Ithaca, New York, 1911. [63.62.]

Irish Shorthorn Breeders' Association.—Guide Book to Herds belonging to Members of the Association, with short notes regarding the Breeding of the Animals in each Herd. (47 pp. and plates.) 1912. [63.6(415).]

Lydekker, R.—The Horse and its Relatives. (286 pp.) London: G. Allen and Co., 1912. 10*s.* 6*d.* net. [59.9; 63.61.]

Cornwall County Council.—The Feeding and Management of Cattle and the Manuring of Crops. (167 pp.) Helston, 1912. [63.62; 63.16.]

Pastoralists' Review Proprietary, Ltd.—The Stockowner's Guide: Appliances and Improvements. (252 pp.) Sydney and Melbourne: The Pastoralists' Review Proprietary, Ltd., 1912. [63.17; 63.6(02).]

Tasmania, Agricultural and Stock Department.—Bull. 26:—Preparation of Wool: from the Paddock to the Sale-Rooms. (6 pp.) [63.761.] Bull. 30:—Annual Losses arising from the Faulty Flaying of Hides and Skins and also from the Bad and Indifferent Branding of Hides. (7 pp.) [63.762.] 1912.

Dairying and Food, General—

Wisconsin Agricultural Experiment Station.—Circ. of Information 32:—The "Coming of Age" of the Babcock Test. (18 pp.) Madison, Wisconsin, 1912. [543.2.]

Bibby's Book on Milk.—Section II.:—The Law relating to the Sale of Milk. [Third edition.] (97 pp.) Liverpool: J. Bibby and Sons, 1912. 1*s.* post free. [614.32.]

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Circ. 202:—A New Method for Determining Fat and Salt in Butter, specially Adapted for Use in Creameries. (8 pp.) Washington, 1912. [543.2.]

Meddelanden från Kungl. Landtbruksstyrelsen, N:r 170:—Berättelse om Svenska Smörprofningarna för År 1911. (71 pp.) Göteborg, 1912. [614.32.]

Tasmania, Agricultural and Stock Department.—Bull. 28:—The Dairy Produce Act, 1910. Regulations briefly explained. (11 pp.) 1911. [614.32.]

Edinburgh and East of Scotland College of Agriculture.—Report XXVI.:—On the Effect of Heavy Root Feeding on the Yield and Composition of Milk. (56 pp.) Edinburgh, 1912. [63.711(*a*).]

Veterinary Science—

*Departmental Committee on Foot-and-Mouth Disease.**—II.:—Minutes of Evidence, Appendices and Index. [Cd. 6244.] (337 pp.) London: Wyman and Sons, 1912. 2*s.* 9*d.* [619.2(*d*).]

Wisconsin Agricultural Experiment Station.—Research Bull. 24:—The Diagnosis of Contagious Abortion in Cattle by Means of the Complement Fixation Test. (217–248 pp.) Madison, Wisconsin, 1912. [619.2(*a*).]

Glynn, E. E., and *Lewis, F. C.*—The Detection of Anthrax Spores in Industrial Material. (227–244 pp.) [Reprinted from "The Journal of Hygiene," Vol. XII., No. 2, June 19, 1912.] [619.2(*b*).]

Tasmania, Agricultural and Stock Department.—Bull. 16:—A Minute on Sheep Diseases [Louping Ill and Braxy]. (16 pp.) 1910. [619.3(*c*).] Bull. 19: A Minute on the Cattle Disease (*Chorea Paralytica Bovis*). (15 pp. + xv. plates.) [619.2.] Bull. 23:—Urinary Troubles in Sheep (Balanitis and Phimosis). (3 pp.) [619.3.] 1911.

Birds, Poultry, and Bees—

India, Memoirs of the Department of Agriculture, Entomological Series.—Vol. IV., No. 1:—Eri Silk. (130 pp. + ix. plates.) Calcutta, 1912. Re. 3. [63.82.]

South Australia, Dept. of Agriculture.—Egg-Laying Competitions, 1911–12. Official Report. (31 pp.) Adelaide, 1912. [63.74.]

Maine Agricultural Experiment Station.—Bull. 191:—Methods for Determining Weights of Parts of Eggs. (20 pp.) [63.74.] Bull. 192:—Breeding Poultry for Egg Production. (64 pp.) [63.651.] Bull. 193:—Poultry Notes, 1910. (24 pp.) [63.651.] Poultry Diseases and their Treatment. (216 pp.) [619.5.] [Twenty-seventh Annual Report, 1911.]

Pennsylvania Department of Agriculture.—Bull. 219:—Increasing the Winter Yield of Eggs. (91 pp.) Harrisburg, 1912. [63.651.]

Tasmania Agricultural and Stock Department.—Bull. 29:—Artificial Incubation. (19 pp.) 1912. [63.65(04).]

Forestry—

Kellogg, R. S., and *Ziegler, E. A.*—The Cost of Growing Timber. (18 pp.) Chicago, 1911. [63.49 : 31.]

Canada Dept. of Interior, Forestry Branch.—Bull. 30:—Forest Products of Canada, 1911; Pulpwood. (17 pp.) Ottawa, 1912. [63.49(71).]

Pearson, R. S.—Commercial Guide to the Forest Economic Products of India. (155 pp. + vi. plates + map.) Calcutta, 1912. 1*s.* 6*d.* [63.49(54).] [This book is issued under the authority of the Government of India.]

Engineering—

Adams, M. B.—Modern Cottage Architecture. [Second edition.] (81 pp. + lxxxiii. plates.) London: B. T. Batsford, 1912. 10*s.* net. [69.]

Economics—

Land Union.—The New Land Taxes and Mineral Rights Duty. The Land Union's Handbook on Provisional Valuations. (186 pp.) London: Vacher and Sons, [1912]. 3*s.* net. [336.22.]

Porter, G. R.—The Progress of the Nation in its various Social and Economic Relations from the beginning of the Nineteenth Century. [New edition, by *F. W. Hirst.*] (735 pp.) London: Methuen and Co., Ltd., 1912. 21*s.* net. [33.]

*Board of Agriculture and Fisheries.**—Memorandum showing Advances from the Development Fund sanctioned by the Lords Commissioners of his Majesty's Treasury, to or through the Board of Agriculture and Fisheries, up to the 31st March, 1912. (10 pp.) [Cd. 6252.] London: Wyman and Sons, 1912. 1½*d.* [37(42); 338.98.]

Switzerland, Publications du Secrétariat suisse des Paysans.—No. 43:—Propositions du Secrétariat suisse des Paysans en vue de l'institution de l'assurance-accidents volontaire agricole. (46 pp.) Berne, 1912. [368.4.]

*Board of Agriculture and Fisheries.**—The Agricultural Output of Great Britain. Report on enquiries made in connection with the Census of Production Act, 1906, relating to the total output of Agricultural Land, the number of persons engaged and the motive power employed. (62 pp.) London: Wyman and Sons, 1912. 9*d.* [31(42).]

Minnesota Agricultural Experiment Station.—Bull. 124:—The Cost of Minnesota Dairy Products, 1904–1909. (104 pp.) [Nineteenth Annual Report, 1910–11.] [338.58; 63.7(73).]

Green, F. E.—The Awakening of England. (369 pp. + 10 plates.) London: Nelson. 2*s.* net. [338.1; 63(42).]

*Departmental Committee on Local Taxation.**—First Report. [Cd. 6304.] (3 pp.) ½*d.* Appendix to First Report. Vol. I.: Minutes of Evidence (15th November, 1911–1st May, 1912). [Cd. 6303—I.] (490 pp.) 4*s.* Vol. II.: Memoranda submitted to the Committee. [Cd. 6303—II.] (160 pp.) 1*s.* 4*d.* London: Wyman and Sons, 1912. [336.28.]

Wateridge, F. W.—Agricultural Reform, or Food-Land the Raw Material (117–156 pp.), and Appendix on Ways and Means (38 pp.). London: Auctioneers' and Estate Agents' Institute, 1912. [338.1.]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P. 10—9. 6,000. 10/12. R. C. & S., Ltd.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE

Vol. XIX. No. 8.

NOVEMBER, 1912.

SUPPLY OF STORE CATTLE AND SLAUGHTER OF YOUNG CALVES.

Some time ago a correspondent called the attention of the Board to the dearness and apparent scarcity of store cattle, and to the fact that in spite of this a large proportion of the calves born in Great Britain each year are slaughtered while quite young. The correspondent's letter and the Board's reply were published in the *Journal* for August, 1911, and in the daily and agricultural Press; while an article on this subject, contributed by Mr. Alfred Mansell, appeared in the *Journal* for April, 1912.

The two main facts—the rise in the price of store cattle and the extent to which young calves are slaughtered—are matters of common knowledge. The annual statistics published by the Board show that in the period from 1906 to 1910 the average price of stores rose by about one-seventh. Exact figures showing the number of calves slaughtered each year are not available, but there is no doubt that, leaving out of account purely dairy breeds, such as Ayrshires and Jerseys, which could not, as a rule, be profitably reared for beef production, the proportion slaughtered to the number reared is very considerable.

It is sometimes suggested that the rise in the price of stores is due to an actual falling off in the supply; this, however, is clearly not the case, for, leaving out of consideration the abnormal year 1911, the number of store cattle imported from Ireland has on the whole steadily increased in the last few years, while the number of cattle in Great Britain, other than cows or heifers in calf or in milk, has remained almost stationary. A comparison of the fluctuations in the prices of both store and fat cattle suggests a more probable explanation of the rise in prices. As is shown by the following figures, and as was pointed out in Part III. of the Agricultural Statistics for 1910, the two classes move on the whole together, and the rise in the price of store cattle during the last few years is almost exactly in proportion to the rise in the value of beef.

	Average for England. Fat Cattle (1st Quality Shorthorn Type) per 14 lb. stone. £ s. d.	Average for Gt. Britain. Stores (1st Quality Shorthorn Type, Two-year-olds) per head. £ s. d.
1906	0 7 6	13 0 0
1907	0 7 10	14 1 0
1908	0 7 11	14 10 0
1909	0 8 2	14 7 0
1910	0 8 7	14 16 0
1911	0 8 2	14 4 0

The figures quoted show that the rearer of store cattle has obtained at least a fair share of the rise in the price of beef; feeders and graziers will perhaps say more than a fair share in view of the rise in the price of feeding stuffs, the cost of which affects the fattener much more than it does the rearer. In any case there can be no doubt that the rearing of cattle has paid better during recent years than for some time previously.

At first sight, it seems remarkable that the increase in price has not apparently resulted in any corresponding increase in the supply. The question, however, is not a simple one of supply and demand, but is complicated by the fact that in this country the farms on which the cattle industry is carried on are, to a great extent, sharply divided into three classes: (1) dairy farms, on which the majority of the calves are bred, but where few are reared; (2) rearing farms, on which calves—both home-bred and purchased—are reared, but not fattened; (3) fattening farms, where purchased store cattle are fattened. There are, of course, many cases where calves are bred, reared, and fattened on the same farm, but the three classes are nevertheless well marked, as is shown by the very small proportion of calves reared in the principal dairying districts, and by the large number of store cattle appearing in our markets every year.*

---

* See *Agricultural Statistics*, Part III. 1911 (pp. 204).

To a great extent this segregation is unavoidable; dairy farmers can spare neither milk for calves, nor land for grazing young stock; rearing can, as a rule, be most economically pursued on farms having a quantity of cheap grass land, which is not good enough for fattening; the grass land on which fattening is pursued is too valuable to be used for rearing, even if it could compete with land at perhaps one-third or one-quarter the rent; while on arable farms cattle often cannot be economically kept at all in summer owing to the absence of grass land and to the requirements of sheep. Still, while this general division is to a great extent necessitated by natural conditions, it is possible that the specialisation is in many cases unnecessary or carried too far; and there is little doubt that there are large numbers of farmers, who at present rely almost entirely on purchased stores, who might with considerable advantage to themselves rear at least a fair proportion of the cattle they require every year. It is impossible to bring actual figures to prove the fact, but there is every reason to believe that under present conditions the rearing of calves may be sufficiently profitable, provided that the business is well understood and properly conducted, and, above all, that the right class of calf is obtained at the outset.

This brings us to the crux of the whole question. In order to attain success in rearing, it is essential to obtain the right kind of calf, and it cannot be too strongly urged that anyone taking up calf rearing should be careful to secure a regular supply of calves of the right breeding. With ill-bred calves, the whole trouble and expense involved in rearing may be utterly thrown away. At the present time, even in the dairying districts of Cheshire and the North of England, where a good class of Shorthorn cow predominates, many calves of a decidedly poor type are bred owing to the use of inferior bulls. Generally, rearers realise that such calves are really not worth buying, and they have to be sold in large numbers every spring for a few shillings a head for immediate slaughter, when perhaps not more than a day or two old.*

---

* Apart from the agricultural aspect of the case, the Board are advised that the use of the meat of immature animals for human consumption is objectionable on grounds of public health. It is the practice in the City of London to condemn

On the other hand, it is usually the case that even when there is a glut of calves at any particular market, animals known to be well-bred are always easily sold, and as a rule the demand for such is much greater than the supply.

Another obstacle in the way of the extension of rearing is the fact that the farms adapted for the business are very often at considerable distances from the dairying districts, the result being that while the dairy farmer finds it difficult to get rid of many of his calves, the rearer finds it even more difficult to secure calves of a good type, and in some districts a newly-born calf, if of fair breeding, cannot be obtained for much less than £3.

Sufficient has been said to show that the problem is by no means a simple one, but the carrying out of the following suggestions would help to solve it, and at the same time prove of advantage to all concerned:—

1. Dairy farmers keeping good general purpose cows, such as Shorthorns, Lincoln Reds, Red Polls, and South Devons, could in most cases rely on a steady demand at satisfactory prices for their calves if they used better bulls than are employed in many cases at present. Formerly, when breeders of pedigree stock paid little attention to milk production, there was some danger of losing milk through the use of really well-bred bulls, but now that so many breeders of dual purpose cattle keep milk records, there is no excuse for the use of bulls of nondescript breeding. A dairy farmer who rears heifer calves naturally has to attach prime importance to milk, but this is much more likely to be secured by using a pedigree bull of which the dam, grandams, and great-grandams are known to have been good milkers than by the use of a non-pedigree animal of which the known breeding goes back perhaps no further than dam and sire. There are, however, many dairy farmers who keep a bull merely to maintain the flow of milk of their cows without any intention of rearing calves at all. In such a case there could be no objection to using a good bull of a purely beef type; and if, as suggested later, they made arrangements to supply calves direct

---

carcasses of calves which weigh less than 48 lb. or are less than three weeks old. The Netherlands Government has prohibited the export to the United Kingdom of calves which weigh less than 21½ kilos (*i.e.* about 48 lb.) without head, skin and intestines.

to a group of rearers, the entire cost of securing a good animal would be well repaid by the better price obtained for the calves. Even where heifer calves are to be kept, it is seldom that the breeder intends to rear calves from more than a few of his best cows, and it is worth considering whether a bull of the beef type could not be used for the others. There would be little difficulty in carrying out such a suggestion, if some system of co-operation were devised whereby each man would have the use of two or more bulls. In order to inspire confidence in the minds of purchasers at a distance, it would be advisable to select for the two purposes bulls of which the progeny would be easily distinguished, *e.g.*, in a Shorthorn herd an Aberdeen-Angus bull, of which the calves would practically all be black and polled, might be selected to produce calves entirely for sale.

2. The question of transport must be considered, though it is not easily solved. A large number of calves are bred in districts where there is no demand for them, and the farms where they are wanted may be anything up to two or three hundred miles away. The calves, when perhaps only a day or two old, have therefore to undergo a long railway journey in addition to the exposure in the market (though by making arrangements beforehand the latter could and ought to be avoided). Apart from the cold and discomfort, which alone in most cases would not be serious, there is bound to be a fairly long fast. In the case of a long journey, the railway companies are required to feed the calves, but it is not easy to provide suitable warm milk at short notice, and the men set to feed the calves—which may not have learned to drink—have no interest in them. This, along with the sudden and often violent change of food, tends to induce scour and other troubles, and it is not surprising that such calves often receive a serious check from which they recover very slowly, if at all. The difficulty would, however, be greatly lessened if the calves were kept for a couple of weeks before being sent away, as they would then have gained strength and learned to drink. At present, dairymen are often unwilling to keep their calves simply because they are almost as difficult to sell at two weeks as they are at two days old.

Given good calves, there is, however, generally a demand, and in many cases there would be little difficulty in the way of keeping them until they are in a fit condition for travelling. In the spring, when the majority of the calves are arriving, there is often a glut of milk, and on cheese-making farms there is usually available for some little time from newly-calved cows a considerable quantity of milk, which is not fit for cheese-making.

Still more could be done by proper treatment of the calves when they reach their destination. After a lengthy journey the animals are usually thirsty, and the natural tendency is to give a good meal at once. This is a great mistake, and is, perhaps more than anything else, responsible for the scour to which purchased calves are so subject. The methods adopted by successful rearers vary a good deal; one of the best is to give a small dose of castor oil and some stimulant in a little warm milk, as soon as the calf arrives, and after an hour or so to give a small meal of milk, which should not be too rich. For the first few days the calf should continue to receive very small quantities of food at a time, though it should be fed as frequently as possible, and at least four times a day. If the least sign of scour * appears, a dose of castor oil should be administered at once, the quantity of food reduced by one-half, and a little chalk given. (It is a good plan to leave a lump of chalk in the calf house, so that the calves can lick it as they like.)

Incidentally it may be said that most cases of scour are caused by insufficiently frequent feeding or by irregularity in the quantity and quality of the food supplied. This explains the well-known fact that a small farmer, whose wife or family looks after the calves, is usually far more successful in rearing than a large farmer who leaves them largely to the management of more or less careless hired labourers. *If dealt with at once,* scour can usually be easily cured by the method suggested above. The common plan of administering astringent materials is wrong in principle, and cannot effect a permanent cure. The real cause of ordinary scour is indigestion, the scour being simply an attempt on the part of the calf's digestive system to get rid of material of which it cannot make use, and the rational system of treatment is to help the calf to clear this out. No treatment, however, will be satisfactory if the calf is allowed to become really ill before it is applied. In such a case the animal usually thrives badly afterwards even if it makes some sort of recovery at the time.

---

* The scour referred to in this article is the ordinary scour and not white scour. The latter is a special affection of bacterial origin, and unfortunately appears under the best *régime*.

3. There remains the problem of providing some means for bringing the breeder of good calves and the would-be rearer into direct touch with one another in cases where they are in different parts of the country. The plan of selling young calves in markets and auctions, with the consequent exposure and delay in transport, is responsible for many of the unsatisfactory features of the question at the present time, and must be strongly deprecated. As a rule, individual rearers want only a few calves at a time, and are unable to guarantee a market for more than a small proportion of the calves a dairy farmer has to sell, but rearers might combine, and after inspection of the cows and arranging terms and safeguards, agree to take the whole of the available calves from a dairy farmer or from a group of dairy farmers, in which case there are few who would not be perfectly willing to let the rearers have a voice in the selection of a bull for at least some of the cows, to give some kind of guarantee that none but calves of the approved breeding will be sent, and to undertake that the calves will be forwarded in such a way as to reach their destination with as little discomfort and injury as possible.

This is a problem well worthy of the attention of farmers' clubs and associations, and if any such feel disposed to go into the question, the Board would be pleased to advise as to what other societies it might be desirable to approach, and to do all they can to facilitate attempts to get into direct communication.

There are other problems, *e.g.*, the fact that the majority of the calves are dropped in the spring, whereas the rearer would prefer a more equable distribution or even to have the majority in winter; the difficulty encountered by the large farmer in finding someone to look after the calves properly; and the occurrence of such diseases as husk and black quarter in calves and of contagious abortion in cows; but the really essential points of the question are those to which attention has been directed above.

FOOT-AND-MOUTH DISEASE.*

PROFESSOR B. BANG, Copenhagen.

FOOT-AND-MOUTH disease is an acutely infectious disease which chiefly attacks ruminating animals and pigs. It is said also to infect horses, dogs, and cats, and even poultry, but such cases are extremely rare and have probably never occurred in this country. Man is attacked occasionally, but, fortunately, not often; to children of tender age the disease may be fatal. Cattle, pigs, and sheep are the animals which are most affected by it.

SYMPTOMS OF THE DISEASE.

From three to six days, as a rule, elapse from the time of infection (but in some cases from two to ten days, and in the case of the pig only one day), before the animal sickens. It is a sort of exanthematic fever—akin to smallpox, measles, scarlet fever, and the like—that is to say, the disease begins with an ache throughout the system, and a fever, which after one to two days is followed by an eruption. When this has come to a head the fever almost or entirely ceases.

The first symptom is, therefore, that the animal seems unwell, eats less, and, if it is a milch cow, gives less milk. The temperature rises at once, to 40 or 41° C. or more in a cow, but this fever lasts only a couple of days, and in slight attacks it may be quite low. Vesicles or bladders begin to form in the mouth, and occasionally on the lips, snout, and nostrils, on the skin round the hoofs—in cattle mostly in the cleft between the hoofs, and in pigs mostly immediately above the hoof on the outside, and in the skin of the foot joint. In many cases the skin round the teats is also attacked, and occasionally eruptions occur in the vagina of female animals.

The eruption consists in the formation of surface vesicles, the epidermis or the epithelium of the mucous membrane being lifted up in many places by an exuded watery liquid. The vesicles are small at the start, but usually increase quickly in size; this is especially the case in cattle, and this fact seems to have some connection with the fact that the epidermis of these animals is very thick, especially between the hoofs and on the tongue, so that it offers great resistance against the exudation pressure. The acute exudation, of course, causes pain, with the result that the animal goes lame, limps badly on the affected limbs, shakes its feet, lies down a great deal, and is unwilling to rise. Sheep and pigs sometimes creep about on their knees. Cows seem afraid to eat, keep the mouth shut, and make a loud smacking noise with their lips. Saliva forms in the mouth, and dribbles out in strings. If the cow's mouth is opened—a process which she is apt to resist—the vesicles above-mentioned will be seen. They occur mostly on the surface of the tongue, especially on the flat part in front, but also on the thick part farthest back. The number of bladders or vesicles is not large as a rule, often only five to six, but frequently they increase quickly in size. They are usually the size of a shilling or a half-crown, and sometimes attain a couple of inches in diameter. Large vesicles are likewise often to be found in the fore part of the toothless gums of the upper jaw, and smaller ones on the inside of the lips, on the palate and cheeks, and less often on the underside of the tongue. As the epithelium on the back of the tongue is very thick it cannot be determined at first whether it really is a case of vesicles, but the eruption takes the form of large flat lumps covered by an apparently normal epithelium. If one tears a hole in one of these lumps, a clear liquid comes out. The epidermis can be loosened for some distance (sometimes one can tear away a piece of "skin" a couple of inches in diameter from the front part of the tongue), revealing a red—often very red—sore which is very apt to bleed. This exposure of the naked mucous membrane causes the animal sharp pain, which it shows by shaking its head violently, and at times it is driven quite wild. A little later the bladders burst by themselves without any such interference, and the loosened epithelium is detached, leaving large red sores. Often, however, the epithelium remains hanging on to either side of the sore, and in its macerated whitish state is then apt to present some resemblance to a loose croupous deposit.

---

* This article is substantially a paper read by Professor Bang before a meeting at the Royal Veterinary and Agricultural College, Copenhagen, on 16th October, 1911, and translated from the *Ugeskrift for Landmaend*, Nos. 43 and 44, 1911. It contains, however, some emendations and additions kindly made by Professor Bang at the Board's request.

Approximately the same process takes place in the cleft between the hoofs. Here the bladders or vesicles mostly begin at the back, but, as a rule, they combine into one immense bladder, which extends throughout the length of the cleft, and after it has burst and shed the whitish-yellow "boiled" looking epidermis a large red sore is exposed.

On the teats the vesicles may at first be very small but numerous. Often there is an annular vesicle round the mouth of the teat itself. The eruptions when occurring on the teats often combine into large, flat, somewhat flabby, irregular vesicles of a whitish-yellow colour. These are naturally easily torn in milking, and the epidermis soon cracks, as it is very thin at this point. The bladders are here also succeeded by reddish surface sores, which take some time to heal on account of the milking.

In other respects it may be said to be characteristic of the disease that it is very superficial. It amounts to a simple raising of the epidermis or epithelium of the mucous membrane caused by a serous exudation. There is no deeply rooted inflammation of the mucous membrane or corium; the sore simply consists in the laying bare of the surface of these parts, and it has a natural tendency to heal quickly. In a case of a deep sore which destroys the corium or mucous membrane itself the healing may be effected by the sore being filled with granulations, and the final healing may take place very slowly through the epidermis gradually stretching out from the sides; but in foot-and-mouth disease there are always small patches of cellular tissue at the base of the sore (down between the papillæ of the mucous membrane), and the sore may therefore in a very short time be covered with newly formed epidermis over the whole surface simultaneously. Thus it is found that these large sores can heal in eight days or less. The locality of the sore may, however, be traced for some time by a smooth, slightly depressed, thin-skinned patch, as, of course, some time elapses before the epidermis reaches its normal thickness.

Owing to secondary infection of the sore more severe inflammation may of course arise later, but this occurs extremely seldom in the mouth, especially when the animal is given suitable soft and clean fodder, whilst it is more apt to happen when the disease attacks the feet, especially the hind legs, and when the animal stands in manure or dirt mixed with urine, as, for instance, in dirty stalls without litter. Under such conditions deep gangrenous inflammation of the skin between the hoofs, sometimes even involving the tendons and joints—the malignant panaritium—is frequently met with, and is due to infection with the necrosis bacillus, which occurs so largely in manure. Other bacteria can, of course, also enter the sore and give rise to inflammatory processes.

The teat sores may, as above stated, become irritated by the milking, and they are also liable to be infected when the animal's litter is dirty, and deeper sores may thus be formed, which will heal slowly. But what is more dangerous still, bacteria may penetrate from the sores which frequently form on the tips of the teats into the lactiferous ducts and cause inflammation of the udder, which often leads to the destruction of one or more quarters.

Apart from these complications, which, under favourable conditions, and when the animal is well looked after, are not very frequent, the disease is usually not a dangerous one. The cow attacked by it is usually very ill for some days, eats little or nothing, gives little milk (which on the other hand contains more fat than under normal conditions), and becomes very emaciated; but about three to four days after the mouth complaint has begun she begins to eat well again, she grows fatter, and resumes giving a satisfactory amount of milk. The foot lesions often cause inconvenience a little while longer, but, given favourable conditions, these also heal surprisingly quickly, and most animals seem quite well again after one to two weeks.

Sheep and pigs usually have less violent attacks than cattle, and they are more liable to the foot disease than to the mouth disease, which often escapes notice. Pigs, however, often shed the entire horn of one or more hoofs, especially when affected animals are forced to walk.

NECESSITY FOR DRASTIC ACTION.

In these circumstances, is it not a very mild disease which it is hardly worth while making such a fuss about? This was the general opinion in the old days. It was not until 1875 that the disease was classified in Denmark as a "malignant infectious disease," for which the law requires that infected cases shall be rigorously isolated. Before that time the public authorities usually did very little to prevent the spread of infection, and, as a result, the disease showed great fluctuations, and was particularly prevalent in 1841–42 and in 1869–71.

It is quite natural that many a farmer whose stock has had the disease in a mild form thinks that the isolation is worse than the disease itself, but it is nevertheless with good reason that general opinion as to the economic significance of the disease has undergone such a remarkable change during the last thirty to forty years. As a result it is now regarded as one of the most harmful diseases among domestic animals, and the greatest efforts are now being made to keep it in check, although, unfortunately, in many places with little success.

It is true that the mortality is mostly low, usually barely ½ per cent. among adult animals, but young calves are very apt to die, and sucking pigs under fourteen days nearly always die when the sow gets the disease; even when older, most sucking pigs die, and the survivors are very apt to be unthrifty.

There are many instances of the disease developing a very malignant character, with a mortality of from 5 to 50 per cent. among adult animals, and from 50 to 80 per cent. among young animals. Malignant epidemics of this kind are most apt to attack dirty and over-crowded farms, but they may also occur under favourable hygienic conditions. The disease may also occur in a very malignant form with numerous sudden deaths reminiscent of anthrax. Such epidemics have been observed in many different countries both in former and recent times. In 1839 2,000 head of cattle died in the Cantons of Berne and Fribourg in Switzerland; and in 1872, in the French Department of Nièvre, more than 20 per cent. of the calves and over 22 per cent. of the pigs were destroyed by the disease in the course of two months. In the summer of 1892 there died in Bavaria over 3,000 head of cattle, and in 1896 in Würtemberg, 1,500. At Barcelona, in Spain, there died in 1901 50 to 70 per cent. of the young cattle. In Transylvania 711 out of 7,498 head of cattle, or 9·4 per cent., were destroyed in 1899. In Holstein and Schleswig the disease occurred last summer (1910) in a distinctly malignant form. According to Dr. Bugge, of Kiel, deaths occurred in practically all the large herds, and in many cases the loss amounted to 5 to 10 per cent. or over. Thus he mentioned instances in which 5 out of 20, 10 out of 80, 10 to 12 out of 100, and 10 out of 200 had died. In the September number of the *Landwirtschaftliches Wochenblatt* a tenant writes that 8 out of his 80 cows had died, and that in two villages in the neighbourhood 25 and 15 cows, respectively, had been destroyed by the disease.

However, it is not these comparatively rare cases of great mortality that cause the chief trouble. It is the acutely infectious nature of the disease which makes it so serious. When it is left alone it spreads to an enormous number of farms, and with the present quick and easy means of communication it may quite easily extend to nearly all the farms of a country or province, with the result that the aggregate of numerous small losses represents in the end an enormous sum. Thus, the loss suffered by Germany in 1892, when over 1,500,000 head of cattle, over 2,000,000 sheep and goats, and over 400,000 pigs were reported to be infected, was estimated at over 100,000,000 marks (£5,000,000), and this year (1911) the loss is sure to be much greater.

This great loss is first and foremost due to the decreased secretion of milk. During the illness itself the yield of milk is nearly always greatly reduced, often to half the normal or less. However, as soon as the animal begins to eat again it usually rises, but it is only in exceptional cases, after very light attacks, that the secretion of milk again comes up to the normal.

Mr. Andersen, veterinary surgeon at Gimlinge, who in 1892–93 had charge of the disease in the part of south-western Sjaelland which suffered most from the disease, states in his report (*Maanedskrift for Dyrlæger*, Vol. X.) that many cattle owners claimed that they were 4·8 lb. short of milk per cow daily after the epidemic. Others reckoned that they only lost 2 to 4 lb. daily, but even this small loss, if it continues throughout the milking period—which it usually does—will amount to a good deal of money. Andersen further writes:

"When a cow sickens six to eight weeks befo due to become dry, at a time when yielding 10 to aily, the dry period begins simultaneously with the disease." This is also an appreciable loss. Moreover, it is not unusual for a cow when attacked by the disease whilst dry to yield very little or no milk after calving, in spite of the fact that the udder is to all appearances healthy. The same may apply to cows calving whilst in the grip of the disease. Occasionally, according to Andersen, it is possible to work up the milk yield from such cows, but it seldom amounts to very much, say, one-quarter to one-half of the normal.

To this it may be added that in nearly all outbreaks some cows contract inflammation of the udder, with the result that many of these cows become more or less worthless for milking, whilst some cows get a malignant and persistent hoof complaint which weakens them greatly. Furthermore, a number of young calves and pigs die, as well as adult animals occasionally; abortion is also liable to occur; tuberculosis may sometimes suddenly attack a herd after it has been through foot-and-mouth disease—and all this without taking into account the emaciation caused by the disease (a matter of great importance when dealing with cattle fattened for killing).

It will be seen from the foregoing that it is hardly an exaggeration to estimate the economic loss from the disease at an average of 30 kroner (=34 shillings) per cow. In Germany, however, the loss is put down at 50 marks (£2 10s.), and Dr. Remmelts tells me that the loss in Holland amounted to at least 25 gulden, or over £2 per cow.

To this must be added the fairly heavy expenses which are required for the proper care of the sick animals and the great loss which in many cases is the inevitable result of the isolation of stock, the issue of notices as to the boiling of milk, and the difficulties in connection with trading, which latter may be of the utmost importance to a country like Denmark, where the export of live cattle constitutes such a valuable item of commerce.

There is thus every reason for dreading the disease and doing everything possible to prevent its gaining a firm footing.

HISTORY OF FOOT-AND-MOUTH DISEASE IN VARIOUS COUNTRIES.

A study of the state of things prevailing in the neighbouring country of Germany will be found very instructive when endeavouring to ascertain what may happen when the disease gains a firm footing. In that country it prevailed uninterruptedly for twenty years, from 1886 to 1905, and twice, in 1892 and 1899, it became terribly prevalent. I give below the number of cattle attacked:—

1886	5,000	1896	710,000
1887	12,000	1897	537,000
1888	37,000	1898	462,000
1889	262,000	1899	1,885,000
1890	432,000	1900	430,000
1891	394,000	1901	80,000
1892	,504,000	1902	20,000
1893	204,000	1903	11,000
1894	93,000	1904	51,000
1895	195,000	1905	9,000

A like number of sheep and goats were attacked by the disease, but fewer pigs.

It will be seen that in the first few years the disease did not assume dangerous proportions, but after three years it spread rapidly, and after another four years it reached its first climax, then went down rapidly for a couple of years, but increased again and reached its second climax in the fourteenth year. After that the figures fell appreciably, and after one or two fluctuations the number of cases was gradually reduced to an almost insignificant figure. The Germans were naturally very gratified at this favourable result, which was attributed to the more stringent regulations imposed by the public authorities. After a short period of official freedom from the disease it again began to assert itself at the end of 1905, but in 1906 only fifty-five communes were attacked by it. Then the figure rose again, and in 1908 324 communes and over 18,000 head of cattle were affected. In 1909 the country was declared free again, but in December the disease reappeared. There is no doubt that during recent years it has been introduced into Germany from the neighbouring countries, especially from Russia, where it seems to have established itself permanently, and from France; but I cannot help thinking that negligence on the part of agriculturists, the concealment of cases of infection, and careless disinfection have had very much to do with it. When the disease is so well known agriculturists are apt to lose interest, and try to evade the inconvenience caused by the public preventive regulations.

During the past season a tremendous wave of the disease, probably the greatest epidemic that has ever taken place, has passed over the whole of central Europe. At the end of May, 1910, it broke out in several districts of East Prussia, and simultaneously at Chemnitz in Saxony. It is said to have been introduced from Russia, and to have spread from cattle bought in a large cattle market in East Prussia. By degrees it extended from east to west over the greater part of the German Empire. In September, 1910, it was only to be found on 244 estates, but on 1st July, 1911, over 20,000 centres were affected, and on 15th September, 1911, 37,180 centres were affected, whilst the number of infected centres in November, 1899, when the disease last reached its climax in Germany, only amounted to 25,407. In the course of time the disease has gone back very much in the eastern provinces, but, on the other hand, it has gained a tremendous hold over the others. Thus, on 15th September there were 5,744 centres affected in Oldenburg, and 7,576 in the province of Schleswig (especially Holstein and South Schleswig). The first outbreak in the latter province occurred in January, 1911, and the disease was thought to have been introduced with affected sheep.

Austria and Hungary were also severely attacked by the disease at the same time as Germany, presumably also through infection from Russia. In these countries it has taken an even greater hold than in Germany. Thus, on 4th October there were 111,382 infected centres in Austria, and on 27th September 45,563 in Croatia and Slavonia. In Hungary the disease has been very general, but is now (1911) confined to 7,961 centres.

In France 33,966 infected centres were notified in August, 1911, and in Belgium, on 31st July, 5,225 centres and over 50,000 head of cattle. In Holland 12,000, and at one time as many as 18,000 centres have been notified, and Dr. Remmelts informed me lately that in the western parts of the country hardly a single herd had been spared, whilst the infection in the eastern part was less prevalent.

In Italy over 18,000 animals were attacked during the week preceding the 6th August, 1911, in addition to 107,000 animals over from the previous weeks. These figures show clearly enough what a scourge to cattle this disease now is in Europe.

HISTORY OF FOOT-AND-MOUTH DISEASE IN DENMARK.

This is instructive in many respects. After the fairly severe epidemic in 1869 and 1870 had died away in the course of 1871, only occasional doubtful cases occurred during the next few years, and in 1875, 1877, and 1878 there were a few series of cases, the nature of which, however, is also partly open to doubt. Thereafter we enjoyed complete immunity until the latter part of 1892, when the disease occurred almost simultaneously in the neighbourhood of Skelskör, at Taasinge, and at Holstebro. Thence it spread fairly rapidly in south-western Sjaelland, and remained in this country until August, 1893. Altogether, however, only 398 holdings were attacked, comprising 10,843 head of cattle, 2,220 sheep, 32 goats, and 6,785 pigs. Of these 398 centres, 362 were located in Sjaelland and Möen, the distribution being as follows: 233 in Sorö district, 61 in Copenhagen and the district of Copenhagen, 35 in Praestö district, 30 in Holbaek district, and 3 in Frederiksborgs district. In other parts of the country it appeared at different points, but only in isolated cases or in very small numbers; thus only 3 centres were affected in Maribo district, 5 in Odense district, 9 in Svendborg district, 1 in Randers district, 10 in Aarhus district, 7 in Ringkobing district, and one in Vejle district —altogether 36 centres.

In no instance was it possible to determine in what way the disease was first introduced into the country—and this was also the case with later epidemics—but there can hardly be any doubt that it came to us from Germany, which was very badly ravaged during that year. I am inclined to connect the dying out of the disease with the introduction of a very careful system of disinfection of the railway wagons used for cattle transport, this disinfection having originally been very faulty.

Later, during the next few years, there occurred a few very remarkable recurrences on estates which the disease had attacked six months to a year previously. Thus it broke out on 20th November, 1893, on the Bjernedegaard estate at Soro, where it had made itself felt for the first time on 16th November, 1892; next on 30th November, 1893, at Dallund (Fyen), where it had occurred for the first time in May of the same year; and on 5th December, 1893, at Rynkevang, near Kallundborg, where the first cases occurred on 12th December, 1892. Finally, on 15th February, 1894, it broke out on the Brorupgaard estate at Slagelse, where it had occurred in March, 1893. At all four places all the cattle which had been born on the estate after the last attack were killed, and also all cattle subsequently added (respectively, twenty-one, four, thirty-five, and, I think, about forty head), whilst I let the greater part of the stock live—that is to say, all the animals which had been through the disease on the previous occasion, and all these animals showed themselves to be immune.

As during this period there was not a trace of the disease elsewhere in this country, and there could not have been any possibility of infection from abroad in any of the places mentioned (except through fodder, which is imported by all farms here), it must be assumed without a doubt that the infection had remained hidden on the farm from the previous attack. All the houses were therefore subjected to a very thorough disinfection, and, especially at Brorupgaard, I remember that some rather expensive improvements were carried out in the woodwork of the buildings. Nevertheless, strangely enough, the disease returned a third time on this farm, on 2nd March, 1895, that is to say, over a year later. On this occasion all animals introduced to or born on the farm since the previous outbreak were also killed immediately, making seventy-seven head of cattle in all, whilst I allowed all animals which had previously had the disease to live. They all proved to be immune, even those which had had the disease two years previously. The only possible explanation seemed to be, according to the farm people, that shortly before the appearance of the disease the cattle had been fed on hay which had been lying in the loft over the cowhouse since the previous outbreak. This hay was of course burnt, together with any other fodder which might possibly be thought to have been infected through the boots or clothes of the cow-man, and a large sum of money was also spent on rebuilding the cow-house, from which all woodwork was removed and replaced by iron, stone, and cement. Since then the disease has not reappeared on this estate.

It is, of course, doubtful whether the infection was really lodged in the hay, but it will be readily understood that since then I have been very anxious not to leave any fodder which might possibly be infected on farms where cattle have been killed.

These four, or rather five, recurrences at the end of six months to a year show in each instance that the virus may possess much greater tenacity than is usually supposed. It is generally taught that the virus can be destroyed fairly quickly, say, for instance, after desiccation for twenty-four hours, and that it is fairly easily killed by means of ordinary disinfectants. But, nevertheless, it has also been found that it may remain active in an attenuated condition for three to four months in hermetically sealed glass tubes, and this is further supported by the experience which we had this year in Jutland, where the disease in the neighbourhood of Aarhus returned about three months after an outbreak and a few days after carting out the manure left from the stock which was first attacked. It is therefore advisable in practice to assume that the virus may persist for a very long time.

Of course it may be questioned whether the recurrences referred to may not be attributed to entirely different causes connected with what we have learnt in recent times about various contagious matters, as, for instance, in the case of human typhoid, where certain individuals, so-called "bacillus carriers," although apparently cured, nevertheless continue for years to give off virus, and may prove a great danger to the community as carriers of infection. In the case of foot-and-mouth disease, however, this hypothesis is controverted by the fact that I allowed the animals which had previously been through the disease to live, and that the disease nevertheless died out in the first three instances after the second outbreak and in the fourth instance after the third outbreak.

In another respect also my observations are very interesting. I refer to the question whether cattle as a rule acquire immunity by passing through the disease. On all the four farms this proved to be the case, and at Brorupgaard the immunity lasted two years. The text-books on the subject state that immunity is frequently acquired (some authors put it down at three to five or seven years), but that such immunity may in very many cases be of short *duration*; in fact, it is asserted that cattle are quite frequently attacked by the disease several times in the course of one year. It may, however, be safely assumed that these are rare exceptions; I firmly believe that immunity is the rule. Seeing that, for instance, in Germany the disease diminishes appreciably after very widespread outbreaks, I can only conclude that this is largely due to the fact that the cattle have in many cases acquired immunity for a more or less protracted period. I do not think that Dr. Bugge, of Kiel, was right when he prophesied to the farmers in Holstein and Schleswig that the disease will spread still further next year (1912)—I hope that the contrary will be the case.

During the period from August 1893 to April 1896 we experienced in Denmark only the above-mentioned five cases on farms which had previously suffered from the disease. But subsequently, during the years 1896–1901, we had each year a few outbreaks, all of which were stopped very quickly by killing all the ruminants and swine on the farm. In some cases the disease spread to a limited number of other herds in the same neighbourhood, chiefly through the dairies, but in other cases it was limited to the farm which it had first attacked. In 1896 we had three outbreaks, *i.e.*, on 7th April at Bonderup, near Korsör; on 14th October on a farm at Nebbelund, near Rödby; and on 14th December at Havsgaard (Langeland). At the first-mentioned place 190 head of cattle, 13 sheep, and 152 pigs were killed. Here the disease spread during the following weeks to six other herds, partly through the milk, partly by means of rats which migrated to a neighbouring property from a cow-house which had been disinfected after killing, and partly through the slaughtermen engaged at Bonderup.

This circumstance—in conjunction with the fact that animals killed in the country under such conditions fetch relatively little—induced me in all recent cases to adopt the radical measure of burying the slaughtered animals (excepting the few which could be used on the farm) in a large pit, to which they were led and where they were shot. In this way the casualties within a herd can be ended quickly, and in many cases before the disease has had time to attack many animals. It is obvious that the danger of infection is thus reduced as far as possible. It is, for instance, a means of dispensing with the services of slaughtermen, who are very dangerous carriers of infection. It is a little more expensive, but if one has at any rate to spend thousands of kroner in stamping out the disease, I think it best to take radical measures at once. The result has in all cases justified this view. From the second outbreak at Rödby the disease spread partly through the milk and partly through the neighbours to seven herds, which were at once destroyed.

In 1897 also we had three outbreaks, viz., on 24th January and 24th October on two farms at Nysted and at Saksköbing, and on 12th February on a farm at Odense (Bellinge). From here it spread to three other estates, partly as a result of their proximity and partly through personal contact.

In 1898 the disease broke out on 13th November on the farm of Nottrupsgaard in the southern part of the commune of Bjerre.

On 25th March, 1899, a large peasant farm west of Rödby was attacked by the disease.

In 1900 we again had three outbreaks, viz., on 3rd January on a farm at Radstad, near Saksköbing; on 27th January at Odegaard, barely 4½ miles away; and on 7th January on a farm at Nyborg. The connection between Radstad and Odegaard is not clear; it is thought that perhaps game may have carried the infection. From Odegaard it spread to five other farms at Vigsnæs, all of which had had milk returned to them from a dairy which had been supplied with Odegaard milk. Unfortunately, the dairyman omitted to carry out the pasteurisation properly, and this, without a doubt, was the cause of the infection. Finally, two months later the herd on a farm near Odegaard contracted the disease. Possibly the sending out of manure may have been the cause in this case.

On 20th January, 1901, the disease reached a farm in the neighbourhood of Nysted.

After that we had a period of immunity until the 1st February, 1904, when the disease suddenly broke out in the island of Sjaelland, on a farm at Fröslęy in the southern part of Stevns. This herd was killed, but when the disease nine days later made its entry on the neighbouring farm, the then Minister of Agriculture would not continue the killing. Although much was done to prevent the disease from spreading, and, for instance, one, and later on, two veterinary surgeons were despatched to Storehedinge in order, as far as possible, to save the local men from having anything to do with the disease, it spread during the following months to twenty other herds, of which only one lay outside Stevns. In seven cases personal contact could be proved to have proceded the outbreak of the disease, and in three other cases this was probably also the cause. In one case infection was put down to mating with an infected bull. In several cases the infection was probably transmitted by the carting out of manure from infected herds. To the last place the infection was probably carried by rooks, which had a colony close by. In addition to the herd first mentioned, killing was subsequently resorted to in one single small herd at Stevns, and also in the case of the small herd outside Stevns, which was the last to be attacked. This last outbreak occurred on 13th June.

Subsequently, Denmark remained free from the disease for six and a half years, until 24th November, 1910. On that day it was discovered on a holding at Valby Mark, near Slagelse. The herd was at once destroyed, and since then the disease has not been known in Sjaelland.

On 12th December, however, it broke out on a large farm just outside Kolding, and on 13th December on a peasant farm at Lillering, west of Aarhus. The herds on both farms were destroyed at once, but on 26th December the herd of a tenant at Skovby, close to Lillering, became infected. After the slaughter of this herd no further outbreak occurred until the middle of March, 1911, when the disease appeared on the farm of one of the neighbours of the above-mentioned tenant. When the manure was carried out into the fields to be ploughed in it was noticed that numerous rooks settled on it, and thereupon flew away to a neighbour's turnip-pit which had just been opened for fetching home turnips. A few days later this man's cows became infected, and the disease now spread to five herds in all, in two cases doubtless through personal contact. All herds were killed as quickly as possible, and all manure from these farms was buried.

At the end of April and the beginning of May the disease attacked two small adjoining farms in North Falster, and in July it appeared on a peasant farm in Langeland, close to the east coast of the island. These herds were also destroyed.

WAYS IN WHICH THE DISEASE IS TRANSMITTED.

As previously stated, it has not been possible in any one of the fairly numerous outbreaks of foot-and-mouth disease which we have had to deal with since October, 1892, to prove in what way the infection was conveyed to the herd which first became infected. It is a striking fact, however, that the disease has, with very few exceptions, been restricted to estates in the southern part of the country—chiefly Lolland, Langeland, South Sjaelland, Fyen, Southern Jutland (Kolding and the neighbourhood near the Vejle Fjord); and that once only, in 1892, it attacked Holstebro, and once, in 1910, the neighbourhood west of Aarhus. An estate close to the coast has had more frequent recurrences of the disease than any. This fact is difficult to understand on the assumption that the infection is conveyed by fodder from foreign countries, which is distributed throughout Denmark; but, on the other hand, it points distinctly to the infection being carried hither from Germany, where the disease has existed continuously. It must be a natural mode of transport, but which? I have thought for many years that it might be birds, such as gulls, crows, rooks, etc., which might conceivably fly across from Germany and carry infection on their feet, or possibly in their intestines, after having collected it from infected manure. I also do not think it impossible that the infection may have been carried by the wind. It might be a question of particles floating in the air in a free condition, or attached to the legs of insects, or possibly spiders' webs, called in Danish the "flying summer," which just at this time of the year are en flying about in profusion.

The virus itself is not known, but it has been proved to exist in the matter contained in the vesicles, and to be liberated when these burst. Thus it comes out in the saliva, the manure (after passing through the intestines), and the matter discharged from the vesicles on hoofs and udders. It is known that the virus is a very minute object—doubtless a microbe—and that it passes through the pores of a filter: that is to say, it is smaller than the smallest of the bacteria visible under a microscope. It is likewise known that very little is needed to infect an animal with the disease, inoculation with $\frac{1}{1000}$th of a c.c. of the contents of a vesicle being sufficient. Such small objects do not require large means of transport.

I have not had time to examine very closely the direction of the winds prevailing at the various points where the disease has appeared, but a cursory inspection of the printed records of a meteorological institution shows that southerly, and sometimes south-westerly and south-easterly, winds have been blowing before each outbreak.

The remarkable fact that the disease may break out in an otherwise healthy country without any apparent cause has been observed several times in England, which is no more inclined than Denmark to receive animals with foot-and-mouth disease from infected countries. The theory of the wind as an infection-carrier is an old one, and in Holland observations have recently been made which seem to support it.

In Sweden observations were once made which seem to indicate that the infection can remain for a long time with an animal which has passed through the disease. A Dutch bull was once, after undergoing the prescribed period of quarantine, imported into a herd in the far north of Sweden, and several months later this herd was visited by the disease. It was then found that the Dutch bull had a deep slit at the back of the hoof—such as is often formed during the disease when the horn comes off—and that this slit, just at the time that the disease broke out in the herd, had grown so far down as to release, presumably, the virus hidden in it. But there can be no question of any such infection in Denmark, as in no case have cattle been imported from abroad.

Whatever may be the connection between the various cases here and foreign importation, it is plain that at the present time we are very liable to receive infection from Germany. It is difficult enough to avoid its introduction through persons who have visited German cattle markets or who have come into touch with infected herds in Germany, but we are quite at a loss to cope with infection carried by birds or by the wind. The frequent occurrence of the disease at the time of year when turnip leaves are used as fodder might indicate that the latter are especially liable to carry the disease. This could not be the case if the turnip leaves were used in the form of silage fodder. Although, for the reasons above stated, I do not believe much in the carriage of infection through foreign fodder or packing, it cannot, of course, be denied that there is something in the suspicion. The same applies to railway wagons used for cattle transport in Germany.

During the past month (Sept., 1911) the disease has assumed somewhat disquieting proportions in our country. On 23rd September it appeared on a large farm, Nordenbrogaard, in the southern part of Langeland. Although the cattle were killed, not only there but also on three smaller estates in the neighbourhood, the disease nevertheless spread to two other large farms in the vicinity, namely Brolykke and Tryggelevgaard, and to four small farms near the latter. In Lolland it made its appearance in a very large herd at Fredsholm, near Nakskov, and later it broke out at Halstedgaard, Arevlund, and Rudbjerggaard in the same neighbourhood, and at a small holding at Vaabensted, near Sakskobing, and another small holding at Langö, close by the Nakskovfjord. These two small herds were killed, but naturally it was not thought right to expend the large sums that would have been required to destroy the large herds.

In Fyen the disease appeared on 6th October on a peasant farm at Vantinge, west of Ringe, and the next day at Hvedholm, near Faaborg, and on a peasant farm at Drejö. These herds were allowed to live, and the disease has since appeared in nine other small herds in the part south of Odense, at Fraugde and neighbouring parishes. In some cases the mode of infection has been easy to trace, animals having been moved from one infected herd, where the disease was not discovered in time, to other herds. In other cases it was clearly due to human agency, or it may have passed on to neighbouring properties, but in some instances the connection has not been explained. In a densely populated district with close intercourse there are, however, plenty of opportunities for the infection to be carried, even if the means are not always clear. Birds and the wind may, of course, play an important part. In Fyen the method of slaughter has hitherto only been applied in three small herds.

Jutland has not been free either, and on 3rd October the disease was discovered on a small peasant farm at Scaksrode, close to Vejle Fjord (Commune of Bjerre). The herd was slaughtered immediately, and up to the present there have been no recurrences there.*

All this looks very disquieting, and some uneasiness is naturally felt as to how things will go this winter and next year. Are we possibly face to face with a great visitation of the dreaded disease, which may invade the whole country and cause incalculable loss by depreciating the value of our herds and giving rise to unavoidable interference with our trade? One might almost be inclined to believe it. There are enough grounds for anxiety, and it is necessary for every stock-owner to be on his guard, so as to avoid all possible contact with infected herds, either directly or indirectly; but it seems to me that the summary which I have given of the history of the disease in this country may serve to allay our fears to some extent. It is true that we have had many outbreaks, but we have succeeded in checking them quickly by killing sundry herds or groups of herds infected by those which were first attacked; and even in 1892 and 1893, as well as in 1904, when we did not resort to killing, we succeeded by effective isolation in keeping the disease within reasonable bounds, with the result that the situation here has been much better than in Germany and many other countries.

To succeed we require, however, in the first and foremost place, great vigilance, so that cases of disease may be notified to the veterinary surgeons without any delay, and necessary steps be taken to isolate the infected herds as effectively as possible. These precautionary measures of isolation must be carried out with forethought and thoroughness. It must be borne in mind that the virus in the case of this disease is extraordinarily liable to be transmitted, much more so than in the case of any other disease. It adheres to clothing and articles, and may, for instance, without a doubt be conveyed to a herd of animals through a person who has not himself been in an infected building, but who has merely been in close contact with someone who has been there. The intimate social intercourse prevailing in this country undoubtedly means an increased risk of infection, and such intercourse should, therefore, in times such as these be greatly restricted.

---

* Since this paper was read there has unfortunately been a case in Sjaelland, on 23rd October, on a small holding at Flakkeberg Mark, near Dalmose. This herd is being slaughtered.

Fortunately the disease has not so far been of a malignant character. Doubtless a number of young calves and pigs have died, and also occasionally older pigs, but hitherto there have been no casualties among adult animals, and the loss of milk seems hitherto in most places to have been moderate. This may, however, easily change, and I fear that it will probably be found in time that owners of herds which are visited by the epidemic may sustain appreciable losses.

The treatment of diseased animals consists first and foremost in very thorough care. Suitable soft and clean fodder and ready access to water are the most important requirements as regards the mouth complaint, and dry and clean litter, with ample straw, is of the utmost importance when dealing with the teat and hoof complaints. Proper cleaning of the stalls and good ventilation are also very important. There is no specifically acting remedy as far as we know, and in its usual mild form no medicinal treatment is needed for the mouth disease. The affected teats and hoofs may, however, occasionally benefit by expert veterinary treatment.

RECENT HISTORY OF THE DISEASE IN DENMARK.

According to a desire expressed by Sir Thomas Elliott, I add to the above paper a short description of the history of foot-and-mouth disease in Denmark during the period from October, 1911, to July, 1912.

In the isle of *Langeland*, where the disease began on the 23rd September, it spread to 50 herds altogether, chiefly in the southern half of the isle. The last case occurred on 27th February, 1912.

In *Fyen, during the period from 6th October, 1911, till* 3rd April, 1912, 352 herds were attacked. At first the disease occurred especially in the centre of the island, with a few scattered cases in the southern and western parts; but later on it extended very widely in the northern part, where from December to February more than 100 herds were attacked. After 3rd April only three cases occurred in Fyen, all in June. In two of these cases the disease appeared in newly bought cattle on farms where it had existed in January; the third case originated from contagion from one of those farms. Since that time the island has been free from the disease.

In a small island, *Drejó,* south of Fyen, only the one case already mentioned occurred. In the somewhat larger island, *Acró,* 32 cases occurred between 1st November and the end of February.

In *Lolland*, as mentioned, the disease began on 29th September among a large herd (358 head of cattle), and in the course of the following months it spread greatly in the western part of the island, and later also in the southern part. On the whole, 121 herds were attacked. After the end of March only very few herds were attacked in this island, the last one on 17th April.

In *Falster* 52 herds were attacked between 24th October and 12th May.

In the isle of *Móen,* east of Falster, only one herd has been attacked—in the middle of April; and in *Bornholm* also only one case appeared—on the 3rd of December. The animals in this herd were immediately killed.

In *Sjaelland* the disease was very widespread (577 herds). It appeared here on 24th and 28th October on two small farms near each other in the south-western part of the island. Both herds were immediately killed, but on the 1st, 2nd, and 4th November it appeared in five herds, of which three were very large: three of these were in the south-west part of the island, two were far off in the north and east. The disease subsequently spread over a large part of the island; the cases partly were scattered, but mostly occurred in larger or smaller groups; the disease was most widespread on the

Steons peninsula on the east side of Sjaelland, where 90 herds were attacked in February–March. The last outbreak in Sjaelland and also in Denmark occurred on 29th July.

In *Jutland* the disease, as mentioned in the above paper, broke out on the 3rd October on a small farm north of Vejle Fjords in the south-eastern part of the country. In the beginning of November it appeared on a farm in the neighbourhood of the first one, and on a large farm south of Kolding near the Schleswig frontier. In each of these places the herd was killed, but on the 14th November the disease broke out on a large farm east of Horsens, and in the following months it spread to several farms, especially in the neighbourhood of Horsens, Vejle, and Fredericia, together with some scattered cases a little more to the south and west. It did not, however, extend far up in Jutland, and only 92 herds were attacked; the last outbreak but one was on the 3rd April, and the very last in this part of the country took place on the 27th June.

During this epidemic *in all Denmark*, on the whole 1,285 herds were attacked, consisting of 48,330 head of cattle, 2,801 sheep, 80 goats, and 34,871 swine. Swine were diseased on half the farms only, and in many cases sheep were also exempt. As Denmark has about 2,250,000 head of cattle, it appears that only about 2 per cent. of the cattle have been diseased.

In the beginning of the epidemic we attempted to stop the disease by killing as fast as possible all ruminants and swine on the diseased farms, but as at the end of September and the beginning of October the disease attacked several very large herds, this procedure had to be given up. Later on, however, a few herds were killed, when the disease broke out in parts of the country hitherto free. Altogether slaughtering was carried out in the case of 32 herds, comprising 388 cattle, 21 sheep, and 314 swine, and the cost amounted to about 100,000 Danish crowns (£5,500).

Moreover, the disease was combated by thorough isolation of the infected farms, and by prohibiting the removal of live animals, as well as of untreated milk, hay, and straw, regulations as to tying up dogs, isolation of poultry, etc. In smaller or larger areas round the affected herds the movement of ruminants and swine was also restricted, etc., and it was forbidden to transport such animals and hay and straw from the islands to Jutland, as well as to other countries. Among the other measures taken must be named the compulsory heating of all skimmed milk, butter milk, and whey in the co-operative dairies in the affected parts of the country, before these products were sent back from the dairies to the farmers, in order to prevent infection by feeding them to calves and pigs.

As I considered it very probable that fæces of diseased animals might be a means of spreading the germs, *i.e.*, through animals, especially birds, I induced the Government to pass an order on 3rd January, directing the manure made during the period of the prevalence of the disease to be buried or at least covered with a layer of earth, sufficient to prevent poultry or other birds coming into contact with it.

In some parts of the country, especially in Jutland, young veterinary surgeons were engaged to superintend the infected herds, in order not to expose the practising veterinary surgeons to the risk of carrying the germs from infected herds to other farms, and in the last months of the epidemic we were able to apply this measure in all cases.

In the above paper I called attention to the fact that in the different outbreaks of foot-and-mouth disease it had never been possible to prove in what way the infection was carried to the herd which first became infected. The same was the case in this epidemic. This time the disease began almost simultaneously in several places in the southern part of the country, though there was not the slightest communication between the farms. On the 29th September it came to Fredsholm by Nakskov (Lolland), and on 3rd October it appeared simultaneously at Saxkobing (Lolland) and in Staksrode (southern Jutland), and on 7th October at the same time in five places in Fyen. Considering that just at that time the disease reached its greatest frequency in northern Germany (there were in Schleswig-Holstein on 31st August, 15th September, and 30th September, 7,808, 7,576, and 6,341 infected herds respectively, and in Mecklenburg on these dates, 644, 443, and 702 infected herds), there can be no doubt that in some way or other contagion must have been brought to Denmark from these countries. And, considering that in the last week of September and 3rd and 4th October chiefly south-westerly and southerly winds prevailed over the southern part of Denmark, it seems very probable that the germs were carried with the wind from infected farms in Germany to the Danish islands.

After the importation of the disease into Denmark, it was in several cases easily seen how it was spread by the cattle trade, or by moving cattle into shelter, and there were reasons for supposing that dogs, cats, rats, or birds had spread the contagion, or that it had been transmitted through infected milk, or milk churns, or railway trucks. But many cases remained in which it was impossible to find the way in which the disease had spread, and in some cases it was probable that the wind had played a part.

The disease varied greatly in character. In many cases it was mild and did not cause great losses; in many cases it was rather malignant.

With regard to mortality, we have exact information only for a little more than half the herds. In these, 3·4 per cent. of cattle died. Of these far the larger number were calves (84·6 per cent.), and among adult cattle the mortality was only 0·5 per cent. Out of 305 herds of swine, comprising 9,227 animals, 1,403, or 14·4 per cent., died; 78·3 per cent. of these were sucking pigs, 20·6 per cent. young pigs, and 1 per cent. older pigs.

The loss of milk was in many cases considerable, not only during the period in which the disease was prevalent, but long afterwards, and there were among the cattle many cases of malignant udder inflammation, of abortion and temporary sterility. Thus also in this country foot-and-mouth disease has proved a plague, the combating of which is well worth great sacrifices.

TOR-GRASS OR FALSE BROME AND ITS ERADICATION FROM DOWN PASTURES.

HENRY P. HUTCHINSON, B.Sc.
South-Eastern Agricultural College, Wye.

A large area of Down pasture land has little grazing value owing to the presence of the weed *Brachypodium,* commonly known as Tor-grass or False Brome.

Two species of this grass are generally recognised, viz., *Brachypodium pinnatum,* L., or False Brome, and *B. sylvaticum,* or Slender False Brome. The former is the species chiefly met with in pastures; it grows in the open, and may attain a height of 2 ft.; the leaves are long, flat, linear, and rigid, and, being covered with stiff hairs, are rough to the touch. The second species, *B. sylvaticum,* Beauv., grows luxuriantly in such shady places on the borders of woods, copses, and thick hedges, and when established in pastures flourishes equally as well as *B. pinnatum.* It can be readily distinguished from the latter by its broader and more drooping leaves and by other more detailed botanical characters (Fig. 3). Sinclair states that when cultivated in the same soil and equally exposed, the two species appear to approximate closely to each other in a few years, and that cross-fertilisation between the two may occur.

The plant is perennial, and tufted in habit of growth. Many underground stems originate in each tuft (Figs. 1 and 2). These push their way horizontally at about 2 inches below the surface of the ground, and terminate in a cluster of buds, which develop into a bunch of shoots in the next year. In addition to these terminal buds, other buds develop at the nodes of the underground stems, and become aerial shoots later. From these nodes, on the under side, extensive systems of fibrous roots arise. The tuft formation is due to the shortness of these underground stems with their many buds. The leaves and stems die down in the winter, and the persistent dead leaf bases act as a protection against excessive loss of water during the following summer. The plant is further able to withstand excessive dryness owing to its extensive root system. The roots are thin, fibrous, and

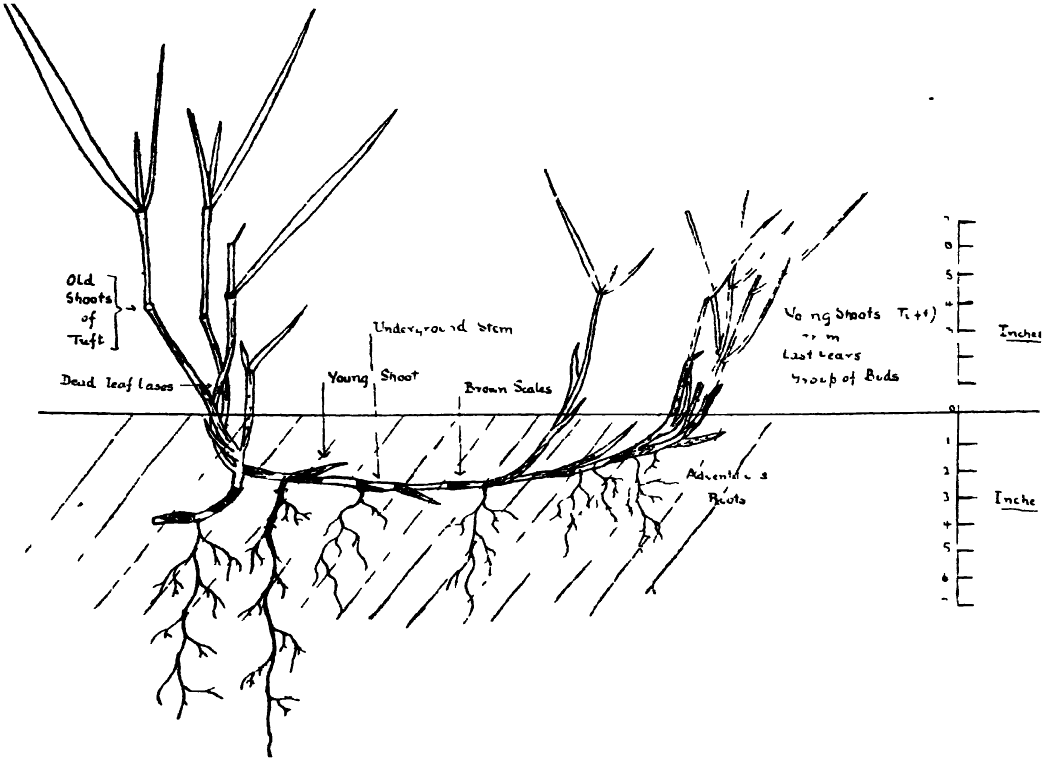


FIG. 1.—BRACHYPODIUM PINNATUM

much-branched, and have a wide range both vertically and laterally. By this means water in the top three feet of soil can be readily and fully utilised.

The plant is spread from place to place by means of its seed. This ripens in late summer, and is carried by the wind to neighbouring land. Here it may germinate, and in time a tuft may be formed. At the time of ripening, sheep will eat the flower-heads. In some districts advantage is taken of this fact to check the spread of the plant, the sheep being allowed the run of the land in late summer. A good example of the rate at which the weed will spread is afforded by a case at Wye. The field concerned (16 acres) is situated on the North Down escarpment, and fifty years ago was arable land. It was then sown down to grass. Tor-grass was introduced by means of seed from the neighbouring thickets, and the patches of this weed now cover about one-third of the whole field. Five acres, at least, may now be regarded as practically worthless. In the same field a piece of ground, three perches in extent, was cleared of Tor in the spring of 1909 by digging out the turf. A few Tor plants appeared in the next year, due either to the sprouting of small pieces of stem left in the ground, or to seed derived from adjoining land. At the present time Tor covers nearly half the plot. If unchecked, the tufts gradually increase in size, as previously explained, and become united. The finer grasses and clovers are thus entirely choked out. From the Down land itself the Tor-grass has come to occupy much of the more fertile pasture land at the foot of the chalk, and now grows luxuriantly in some places on the Gault clay.

Various measures have been tried with the object of eradicating the weed, but nothing entirely satisfactory has been accomplished. It is a regular practice in some parts to burn the grass annually. This can easily be done in dry weather, the dead leaf-bases being readily combustible. The firing leaves large blackened areas, but there appears to be no record of extermination having been effected. In favour of burning it may be said that the fresh growth is more tender and more palatable to stock than the older shoots, and if the operation be carried out sufficiently early in the season, flowering is prevented, and further spread of the plant checked.

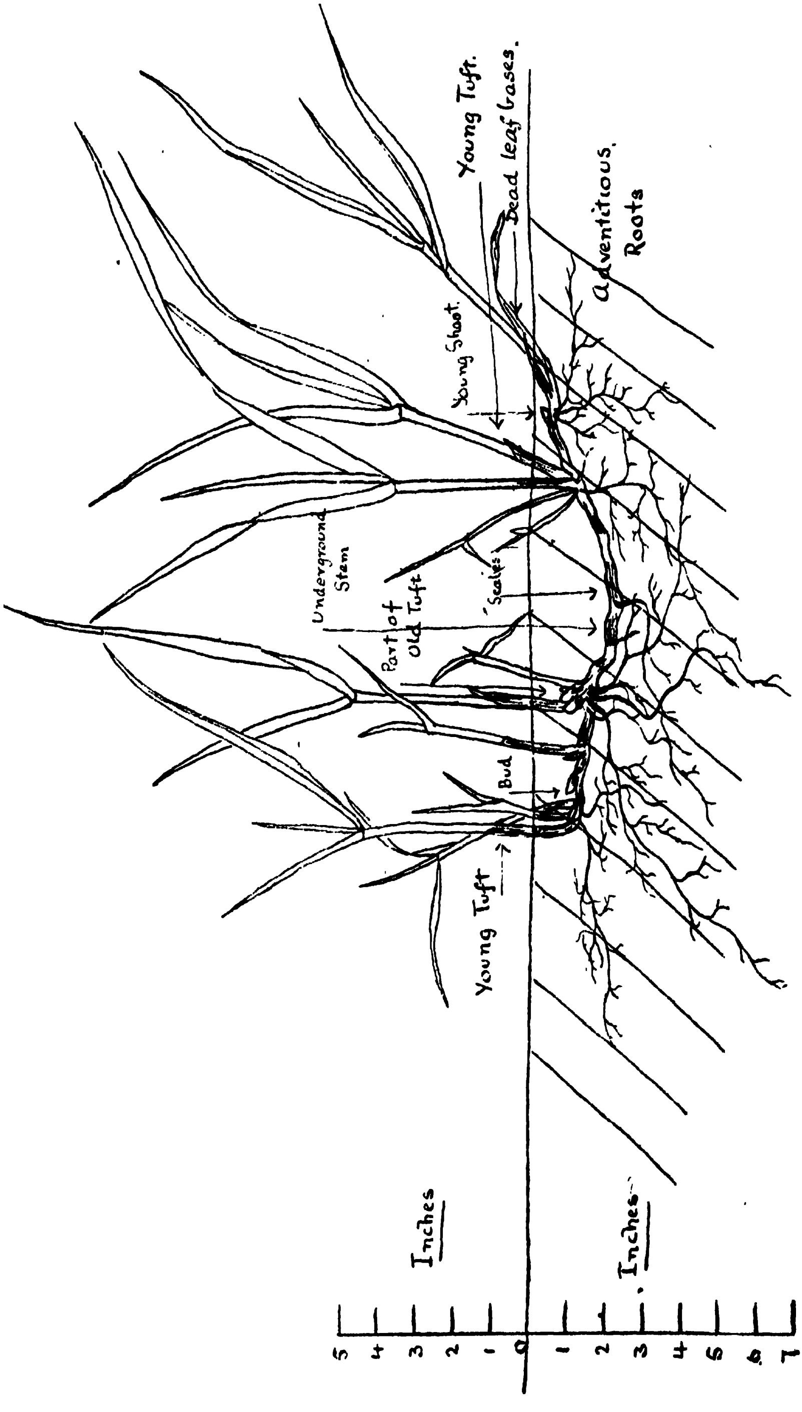


FIG. 2.—BRACHYPODIUM SYLVATICUM.

Application of Quicklime.—In November, 1909, some tufts of Tor were covered with about 2 inches of quicklime. The winter rains panned the lime in places, and in the spring the young shoots failed to grow through. The check was only temporary, however, for later in the summer growth proceeded as vigorously as before.

Application of Salt.—In May, 1911, three small plots of Tor, each about 2 perches in extent, were treated with brine of different strengths. These salted plots were much relished by the sheep and cattle, and the grass was eaten down close. The stock suffered no ill-effects; but since the old leaf-bases could hardly be regarded as having much feeding value, little benefit could be expected from the feed. After the salt had been washed away by the rains, grazing almost ceased on these plots, and by the end of the summer the thick tufts were again developing. No flowering occurred, and the close eating of the tufts appeared to assist the growth of the finer grasses between the tufts.

Effect of Digging.—In the spring of 1909, 3 perches of Tor-grass were cleared by digging, as already stated. The turf was thrown aside—the soil by this means being removed to a depth of 3 or 4 inches and the subsoil exposed. The latter was forked over, brought to a fine tilth, and sown down with a mixture suitable for land of this type. The seeds germinated satisfactorily, but the plants were weak, and the sward ultimately formed was thin. This is what might have been expected, since the top soil with its humus and readily available plant food was removed with the turf. Soil is, as a rule, thin on the hill sides, and should be retained as much as possible.

A study of the underground system of the plant shows that it is unnecessary to dig deeper than 3 inches in order to eradicate the weed. The underground stems never run deeper than this, and they alone give rise to new shoots.

Digging and Burning.—In March, 1910, 6 perches of Tor-grass were cleared by digging. The turf was allowed to dry, then barrowed into heaps, and burnt. The burning was slow, and required attention twice daily for the first week and once daily afterwards. A man experienced in turf or ballast burning is desirable for the work, as there is an art in

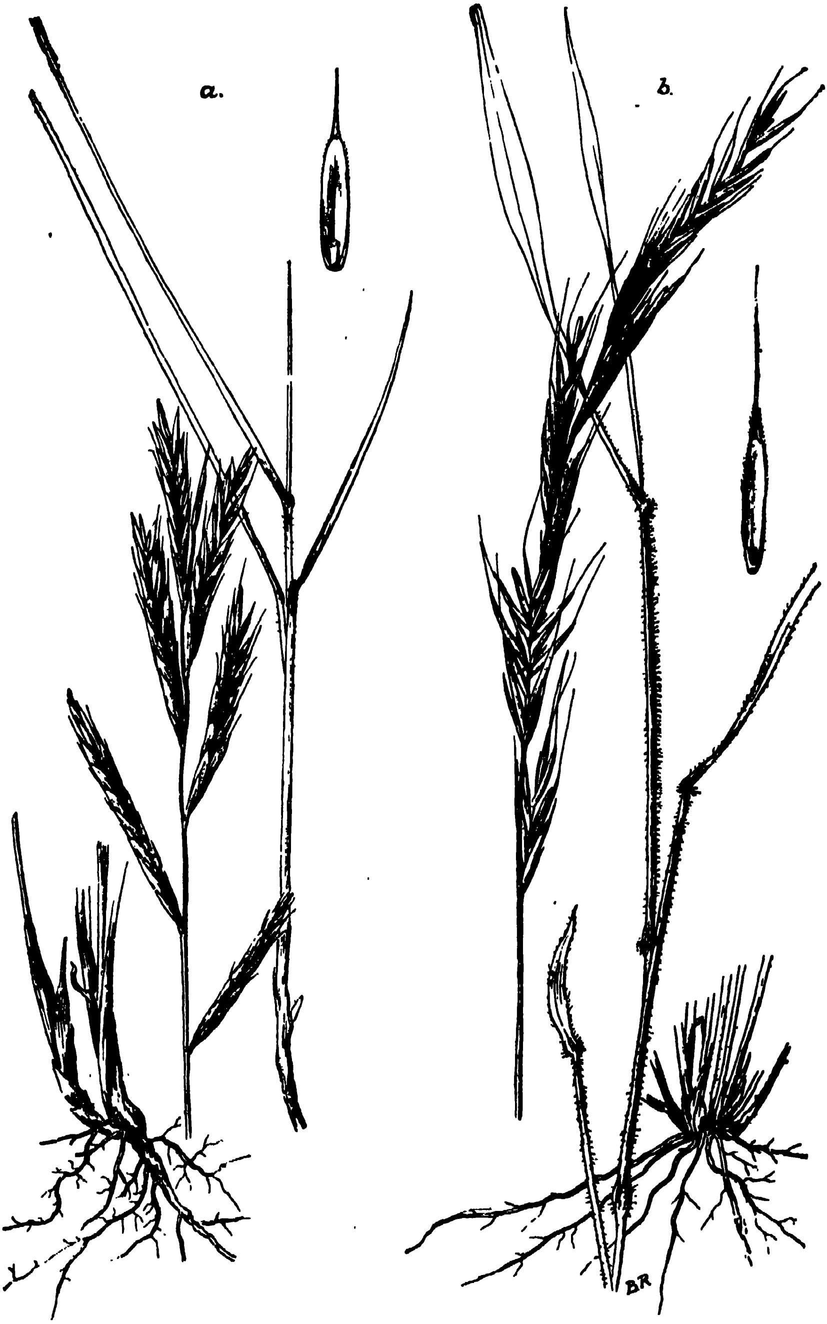


FIG. 3.—FALSE BROME OR "TOR" GRASS.
(*a. Brachypodium pinnatum ; b. B. sylvaticum.*)

knowing how to place the sods when feeding the fire. The heaps were completely burnt out at the end of from nine to twelve days, according to size. The fine ashes and burnt earth were spread over the cleared plots, which were then ready for seeding. The cost of this method of treatment—digging, heaping, burning, and spreading—was, as far as could be ascertained from the irregular nature of the work, about £5 10*s*. per acre.

Small pieces of stem, from which new plants may arise, should not be left in the ground. In this case, the digging was done thoroughly, and no new Tor shoots appeared afterwards.

Application of Gas-lime.—Fresh gas-lime has a destructive effect on vegetation, and it was thought that the results to be obtained from its application might be satisfactory. The lime used was obtained locally at 1*s*. per load (about 17 cwt.), and two plots—A and B—were treated in March, 1910.

On Plot A the patches of Tor together amounted to about 12 perches. The turf was dug out, and while still green built into heaps. Gas-lime was mixed with it, being distributed between the layers of turf. The bare ground was also covered with gas-lime, the idea being to kill any shoots which might have been left after digging. About 1 cwt. of gas-lime (per perch) was used in the mixing, and ½ cwt. spread. The heaps were allowed to remain about three months, and in June were thrown back over the cleared areas. At this time the turf was quite dead.

Cost of digging, etc. = 4*d*. per perch
,, gas-lime = 1*d*. ,,
,, carting, etc. = 1*d*. ,,
—
Total cost of clearing = 6*d*. ,, = £4 per acre.

It is very probable that less gas-lime than the quantity used would have been efficacious.

The patches of Tor on Plot B amounted to about 12 perches. Two loads of gas-lime were broadcasted over the area as evenly as possible by means of a shovel. The effect of the treatment was soon evident, and in June—two months after treatment—all the grass appeared to have been killed.

Cost of gas-lime = 2*d*. per perch
,, carting, etc. = 2*d*. ,,
—
Total cost of clearing = 4*d*. ,, = £2 13*s*. 4*d*. per acre.

The amount of gas-lime applied works out approximately at 3 cwt. per perch, and in order to ascertain the minimum quantity required, three other small patches were taken, "a," "b," and "c," and treated in June, 1910.

Amount of gas-lime applied to patch "a" = 1 cwt. per perch
" " " "b" = 2 " "
" " " "c" = 3 " "

Two months later the Tor on patch "a" had been killed in a few places only, but the living tufts showed signs of having had a severe check. On patch "b" the centres of the thickest tufts only remained alive. On patch "c" all the grass had been killed.

The recommendations based on experiences afforded by these experiments are:—

(1) To apply gas-lime, as fresh as possible, directly to the tufts at the rate of about 2½ cwt. per perch. The lime can be applied effectively at any time during the year. Five months, at least, should elapse from the time of application to the time of re-sowing. If it be desired to avoid the unsightly appearance of bare patches during the summer months, the gas-lime should not be applied later than November. Autumn and early winter applications seem to give the best results, as a large quantity of mould can then be worked up with the harrows the next spring.

(2) In places where gas-lime cannot be obtained, and where the Tor-grass exists as small, isolated patches, the best method of eradication would be to dig it out with a suitable spade to a depth of 3 inches. Where large patches occur on land which is not on too steep a slope, the Tor might be ploughed out. The turf would require to be knocked about with chain or grass harrows until dry. It should then be burnt or left until killed by the weather.

(3) The serious deterioration of grass land due to the growth of Tor-grass, and the great cost incurred in renovation, show how essential it is to prevent spreading. Flowering should be prevented by mowing, grazing with sheep, or burning, and young tufts should be grubbed out and burnt when first seen.

Since the above experiments were carried out, it has been found from the use of gas-lime on other plots that its killing power varies. It is strongest when freshly made, diminishing in strength with exposure to the weather, especially rainy weather.

In August, 1910, the odour of the lime applied in the previous March was still strong. Grass and clover seeds were sown in a sample of the mixture of soil and gas-lime taken from the top two inches, but failed to germinate satisfactorily. It was therefore decided to defer further treatment until the following spring.

In April, 1911, the plots were harrowed once with straight-toothed harrows. This gave a fine tilth in the case of all the plots except B. The latter required cross-harrowing before enough fine soil could be worked up to cover the seed.

The Seeding of the Gas-limed Plots.—The soil of the plots rests on, and is derived from, the chalk. It is therefore light and dry in character. The following seeds mixture was prepared as being satisfactory for this type of soil, it being expected that Burnet, Yarrow, and Yellow Trefoil would be introduced in the course of time from the adjoining land:—

Seeds Mixture per Acre.

	lb.		lb.
Cocksfoot	6	Golden Oat-grass	½
Meadow Fescue...	3	Tall Fescue	1½
Tall Oat-grass	3	Hard Fescue	1½
Perennial Rye-grass...	10	Alsike...	1
Italian Rye-grass	2	Perennial Red Clover	2
Crested Dogstail	½	Dutch Clover	2
Smooth-stalked Meadow-grass	1½	Kidney Vetch	2
Rough-stalked Meadow-grass...	1	Bird's-foot Trefoil	1

The cost of the mixture was 30*s*. 6*d*. per acre. The seed was broad-casted by hand (April 10th), and rolled in with a flat roller. In the case of Plot B the seed was harrowed in before being rolled. On all the plots the seeds germinated well. May, however, was a very dry month, and many seedlings perished from drought. The dry weather which followed was unfavourable to growth and to re-sowing, and a sward was not formed until late in the year. In the autumn of 1911 the grasses appeared to be well established, but were too thin on the ground. Few clover plants survived, the majority having succumbed to the dry weather.

The cost of seeding in the case of Plot B was as follows:—

			s.	*d.*	
Cost of Seed		=	30	6	per acre
,, Working	Sowing	=		9	,,
	Harrowing	=	2	0	,,
	Once rolling	=	1	0	,,
Total cost of seeding		=	34	3	,,

Summary of Results.

Plot.	*Treatment.*	*Remarks.*	*Cost.*
1.	Salted	Grass eaten down close by cattle, but not killed.	
2.	Dug and Turf removed	Removal of soil an objection. Pieces of Tor left.	
3.	Dug and Turf burnt	Tor eradicated. Expensive.	= £5 10*s.* 0*d.* per acre.
4.	Dug and Gas-limed	Tor eradicated.	= £4 0*s.* 0*d.* ,,
5.	Top dressed with gas-lime	Tor eradicated.	= £2 13*s.* 4*d.* ,,

To these figures must be added the cost in connection with seeding (34*s.* 3*d.* per acre), which gives in the case of Plot No. 5 a total cost of £4 7*s.* 7*d.* per acre.

HYDROCYANIC ACID FROM LINSEED CAKE.

(1) *Feeding Experiments.*

EXPERIMENTS have recently been conducted by the Board of Agriculture and Fisheries with a view to determine the effect, if any, produced on cattle by feeding with linseed cake yielding a high percentage of hydrocyanic acid on digestion with water.

The Board were informed by an importer that a cargo of linseed had been found to contain an appreciable amount of hydrocyanic acid. A sample was obtained by one of the Board's inspectors and certified by the Principal Chemist of the Government Laboratories to yield ·026 per cent. of hydrocyanic acid. Arrangements were made with a manufacturer to prepare, from this parcel of linseed, cake cold-pressed at a temperature not exceeding 97° F., and cake hot-pressed at a temperature of 160° F. The cold-pressed cake was certified to yield ·038 per cent. of hydrocyanic acid. This cake was fed to a heifer on the Board's farm, 14 lb. being given each day for eight consecutive days, but no ill effects were produced on the animal. Another heifer at the farm was fed on the hot-pressed cake, which was certified to yield ·032 per cent. of hydrocyanic acid. This heifer also received 14 lb. of cake per day for eight consecutive days and no ill effects resulted.

The above rations are very much larger than would ordinarily be given, and the linseed cake contained an exceptionally high percentage of hydrocyanic acid.

It should be noted that the percentages given relate to the quantity of hydrocyanic acid evolved on treating the cake with water, and not to the quantity obtained on acid hydrolysis of the glucoside either in the cake or after the extraction from the cake.

(2) *Effect of Heat on the Ferment giving rise to Hydrocyanic Acid in Linseed.*

The report of the Principal Chemist on the cakes mentioned above shows that nearly the same amount of hydrocyanic acid was obtained from the hot-pressed cake as from the cold-pressed cake on digestion with water.

The following table gives the results. In the fourth column the percentages of nitrogen are stated, and in the fifth column the ratios between the nitrogen and the hydrocyanic acid :—

From Parcel of Linseed.	Seed or Cake.	Percentage of Hydrocyanic Acid.	Total Nitroge per cent.	Ratio. Hydrocyanic Acid to Total Nitrogen.	Seed from
Referred to in Part (1) (Feeding Experiments)	Seed	0·026	3·82	0·0068	River Plate
	Hot-pressed Cake	0·032	5·22	0·0061	River Plate
	Cold-pressed Cake	0·038	4·65	0·0082	River Plate

The result was contrary to the generally accepted view that the activity of the ferment in the linseed on the cyanogenetic glucoside, to which the formation of hydrocyanic acid is due, is destroyed by the heat applied in expressing the oil during the hot-press method of preparing linseed cake (*vide* Professor Dunstan and Dr. Henry, *Journal of the Board of Agriculture*, Volume XIV., 1908, p. 729, and Dr. Henry and Dr. Auld, *Journal of the Society of Chemical Industry*, 1908, p. 430).

It appeared desirable, therefore, that further samples should be examined in order to ascertain whether hydrocyanic acid corresponding in amount with that present in the original linseed is produced by digesting hot-pressed cake with water. Six samples of varieties of linseed were accordingly obtained, together with samples of hot-pressed cake prepared from the linseed, and these were examined by the Principal Chemist of the Government Laboratories.

The following table gives the results in the case of these seeds and cakes:—

From Parcel of Linseed.	Seed or Cake.	Percentage of Hydrocyanic Acid.	Total Nitrogen per cent.	Ratio. Hydrocyanic Acid to Total Nitrogen.	Seed from
No. 1	Seed	0·013	3·50	0·0037	La Plata
	Cake	0·026	5·00	0·0052	,,
No. 2	Seed	0·020	3·35	0·0060	Baltic
	Cake	0·027	4·85	0·0056	,,
No. 3	Seed	0·018	3·21	0·0056	La Plata & Calcutta
	Cake	0·030	4·69	0·0064	,,
No. 4	Seed	0·029	2·84	0·0102	Calcutta
	Cake	0·049	4·22	0·0116	,,
No. 5	Seed	0·024	2·85	0·0084	Calcutta
	Cake	0·044	4·30	0·0102	,,
No. 6	Seed	0·020	2·84	0·0070	Calcutta
	Cake	0·047	4·33	0·0109	,,

It will be seen from the results in column 3 that the absolute percentage of hydrocyanic acid yielded by the cake is considerably greater than that produced by the seed. A direct comparison of these percentages is without value, as the result of removing oil from the seed is to increase the proportions of the remaining constituents in the cake. In order to ascertain whether any change has taken place in the activity of the enzyme in regard to the production of hydrocyanic acid, a comparison may be made between the ratios of the hydrocyanic acid to some other constituent, as, for example, the nitrogen, in the seed before pressing and in the cake after pressing. The ratio should be unaltered if the enzyme has been unaffected by the process. The ratios are given in column 5.

Except in one case the ratio is slightly higher, indicating a greater production of hydrocyanic acid in the cake than in the original seed.

The apparent increase may probably be due to the quantity of hydrocyanic acid in the original seeds being slightly underestimated. This may be accounted for by the fact that it is difficult with laboratory appliances to break down the body of the seed as thoroughly as it is done under the heavy rollers of an oil mill. When the seed is in this imperfectly ground condition, the cyanogenetic glucoside is probably protected to some extent from the action of the water during maceration and distillation.

The results fully confirm those given above, and show that the activity of the enzyme upon the cyanogenetic glucoside is the same after the seed has passed through the hot-press process as it was before.

In a paper published in the *Journal of the South Eastern Agricultural College* (No. 20, 1911, p. 289), a full summary of which appeared in the *Journal* of the Board for September, 1912, Dr. Auld states with reference to the examination of a large number of oil cakes that in no case was a diminished rate of formation of prussic acid noted in cakes of lower oil content which might be assumed to have been pressed at a higher temperature or kept under the influence of heat for a longer period. This statement tends to confirm the above results.

Purchase and Use of Basic Slag.

THE use of basic slag is now so common that it it almost unnecessary to enlarge on its value, or to emphasise the fact that it is one of the first things to be tried when it is desired to effect an improvement in poor pasture, particularly on heavy clay soils. It may, however, be useful to remind those who intend to employ it of a few points which should be observed in its purchase and use.

Basic slag, as is well known, owes its value to the fact that it contains phosphate in a fairly readily available condition, and also a considerable amount of free lime, or of substances which may perform the functions in the soil usually fulfilled by lime. Obviously, then, the first thing to be noticed in buying basic slag is the percentage of phosphate of lime which it contains. Furthermore, the availability of the phosphate in different samples varies. As a rough guide to determine whether the phosphate is likely to become "available" or useful to plants in a reasonable time, a method often adopted, and officially recognised under the Fertilisers and Feeding Stuffs Act, is to ascertain the percentage soluble under standard conditions in a 2 per cent. solution of citric acid. This gives only approximate information, but it may safely be taken that the value of a sample of slag is roughly proportional to its content of phosphate soluble in the approved solution of citric acid.

Fineness of Grinding.—As influencing the availability, the fineness of grinding is extremely important, and along with the guarantee of the amounts of phosphate present, a statement as to the proportion of the slag which will pass through a sieve having 10,000 meshes per square inch should be obtained. This proportion should be not less than 80 per cent., and samples 90 per cent. of which will pass the sieve are readily obtainable.

Most Suitable Grade of Basic Slag.—There is often discussion as to what is the most suitable quality of basic slag. It is possible to obtain so-called basic slag containing very little phosphate at all, and on the other hand the best samples contain up to 50 per cent. of "total phosphate of lime." Also the solubility of this total phosphate varies very much, and there is no definite relation between the richness of slag and its solubility. For instance, in one of a few samples of which detailed analyses are available, the total phosphate of lime amounted to 27 per cent., and 93 per cent. of this was soluble in a 2 per cent. solution of citric acid; in another, containing 45 per cent. total phosphate of lime, only 70 per cent. was soluble; in still another sample, containing 20 per cent. total phosphate of lime, only 66 per cent. was soluble.

The question is chiefly one of cost. From the crop's point of view, what is required is a sufficient supply of available phosphate, and whether this is supplied by a small quantity of a high quality slag, or a large quantity of a low quality slag, is immaterial. Every farmer intending to use basic slag should obtain quotations for different grades from one or two merchants, and calculate what 1 per cent. of citric acid soluble phosphate would cost him in each case. As an example, a case which recently came to notice may be quoted. Two grades of slag, containing 26 per cent. and 34 per cent. "citric soluble phosphate" were offered at 45*s*. and 55*s*. a ton respectively, both quotations including carriage; the cost of 1 per cent. citric acid soluble phosphate in the first case is 45*s*. divided by 26, or 1*s*. 8¾*d*.; in the other case it is 55*s*. divided by 34, or 1*s*. 7½*d*. Clearly the latter is the cheaper manure, and generally speaking it may be said that the higher qualities of slag are really cheaper than the lower grades, particularly when the greater cost of carriage, carting, and distribution of a given quantity of phosphate is taken into account. Without going so far as to say that a purchaser should insist on having a high quality slag, it is probably safe to say that, as a rule, one containing not less than about 15 per cent. of citric acid soluble phosphate should be employed.

Time of Application.—When used for permanent grass land, basic slag is most suitably applied in autumn or early winter, as it is then washed down into the ground before growth starts in the following spring. Generally speaking, October, November, and December are the best months, but January and February are not unsuitable, and there is no fear of loss by drainage or by exposure to the atmosphere whatever time the manure is applied.

Quantity per Acre.—In ordinary manuring the most economical system is to give repeated applications of comparatively small quantities rather than large dressings at one particular time; the case of slag, however, is rather different. Basic slag does not act so much directly on the pasture as indirectly, by first of all encouraging a strong growth of white clover and other leguminous plants, which in their turn enrich and improve the soil in different ways. This growth of white clover is most readily brought about when the pasture is in a poor, unimproved condition, as then the clover has room to develop, and meets with comparatively little competition. The aim should therefore be to get the maximum growth of white clover at once, and it is advisable to try a comparatively large dressing of slag (say, from 7 to 10 cwt. per acre, according to quality) at the very outset rather than a moderate quantity with the intention of repeating the dressing in two or three years. Surprise is frequently expressed at the development of white clover; very often there is apparently none at all in the unimproved pasture. The explanation is that plants are usually present, but as they are very small and dwarfed by unfavourable conditions, they are quite concealed from casual notice by a coarse growth of bent or other grass. Occasionally, however, it may happen that there are none of these small, suppressed plants present, in which case the slag cannot exert its effect. Probably such a case is extremely rare, but if it does occur, a little white clover seed should be sown in the spring following the application of the manure; two or three pounds per acre would be sufficient, and to give it a chance of germination it should be sown fairly early, and the ground thoroughly harrowed before sowing, and well rolled afterwards. There is reason to believe that wild white clover is better than the ordinary variety for this purpose.

It is suggested that a heavy dressing, the effect of which might be expected to last some considerable time, is better than repeated applications of small quantities, but it does not follow that when the effect of the first application is beginning to disappear a second application would not prove profitable and desirable; in many cases where a second application has been given after five or six years, the effects have been very good and profitable, though naturally not so striking as those attending the first manuring.

Danger to Stock.—Sometimes the idea is entertained that basic slag if taken even in small quantities by stock proves highly injurious; it may, therefore, be observed that there is no danger of special injury resulting, even if stock have not been removed from the field at the time the slag is applied.

Basic slag has been used in certain cases as a food, with the special object of supplying bone-making ingredients, with quite satisfactory results. It is, however, advisable to wait until a heavy shower has washed most of the slag off the herbage before turning stock into the pasture.

In conclusion, it is, perhaps, well to point out that, while as a rule basic slag gives excellent results on poor clay soil, a small area should always be treated, and the effect observed before expending any great sum on the manure. It is usually not so well suited for light or chalky soils as for clays, but a field trial must be made before definite conclusions as to its effect can be drawn. On light soils, in addition to trying the effect of slag alone, it is also advisable to test the effect of adding kainit (at the rate of 3 or 4 cwt. per acre). Potash is seldom required on heavy clays, but may be needed just as much as phosphate on light soils. On the poor pastures on which slag proves effective, nitrogenous manuring, either in the form of dung, nitrate of soda, or even cake feeding, seldom does good and often does harm. The improvement of such pastures is best effected by encouraging white clover; direct application of nitrogenous manure tends to help the grass to suppress what little clover is present.

Sugar Beets as Food for Live Stock.

Certain varieties of sugar beets are grown especially for feeding to stock, and not for the manufacture of sugar, both on the Continent and in America. Such a practice has been strongly advocated in the United States on the ground that it familiarises the farmer with the methods of cultivation and harvesting of the crop, and the yield and quality that he is likely to obtain before entering into a contract to grow beet for the sugar factory. Even where beets are grown for the factory, it may in some cases be advisable to grow with them beets for feeding to stock. In the *Report of the United States Department of Agriculture on the Progress of the Sugar Beet Industry in* 1902, it was pointed out that "even where a factory exists, the sugar beets grown for the manufacture of sugar must be kept down to a certain maximum in weight in order to get the quality and purity. This is not true of the stock beets; hence the farmer can produce considerably higher tonnage when growing for stock. It does not require nearly so much labour and expense to grow an acre of beets for stock as it does to grow an acre of beets for the factory."

The value of sugar beets compared with mangolds as a food for stock was investigated by Kellner,† who came to the conclusion that no generalisation on the subject was possible, as it depended to so great an extent on soil and economic conditions (principally supply of labour). The factors which must chiefly be taken into consideration in such a comparison are the cost of cultivation, the yield, and the amount of mineral substances taken away by each crop from the soil. Experiments carried out by Schneidewind * at Lauchstadt in 1905 and 1906 showed that the *dry matter per acre* (roots and leaves) from sugar beet was much greater than from mangolds. The fresh sugar beets contained on the average 1·11 per cent. crude protein and 0·56 per cent. albuminoids, as compared with 0·80 per cent. crude protein and 0·36 per cent. albuminoids from mangolds. The sugar beets took away from the soil more nitrogen and less phosphoric acid and potash than the mangolds. Kellner gives the content of digestible albuminoids and the starch equivalent as 0·3 per cent. and 15·8 per cent. in the case of sugar beets, and 0·1 per cent. and 6·3 per cent. in the case of mangolds, respectively. As regards a comparison between *equal weights of the roots*, experiments in Germany have shown sugar beet to contain about twice as much dry matter as mangolds, and Kellner ‡ therefore recommends, when substituting sugar beets for mangolds, to feed exactly half the quantity.

In an experiment recently carried out at the Harper Adams Agricultural College, bullocks fed on sugar beets (in addition to concentrated foods) increased in live weight at the rate of 2·04 lb. per head per day, while bullocks fed on mangolds increased in live weight at the rate of 1·7 lb. per head per day.

---

† *Arb. der Deut. Landw. Gesell.*, Heft 152, p. 32.

* *Landw. Jahrb.* 36 Bd., 1907, p. 663.

‡ *Scientific Feeding of Animals* (Kellner).

In the case of both roots, the animals were allowed as much as they would consume, *i.e.*, 57 lb. sugar beet per head per day and 75 lb. mangolds. In this trial, therefore, it would appear that, comparing *equal weights of roots*, sugar beets had rather more than 1½ times the value of mangolds for fattening purposes.

According to Shaw,* "sugar beets have a high feeding value compared with other crops, but the cost of growing them as grown for the factory is considerably more than that of growing mangolds; those varieties of sugar beets which produce roots of large size are, however, specially adapted for growing for live stock . . . they are more highly relished than other field roots, and are also more valuable for fat production, but they are not more valuable for feeding young animals to promote growth, and are probably less valuable for producing milk."

Cattle.—Kellner states that 20 to 30 lb. per head per day can be given to cows, and as much as 50 lb. to fattening cattle. He gives the following amounts as being digested by cattle:—

	Mangolds.	*Sugar Beets.*
Organic substances	87 per cent.	92 per cent.
Crude protein	70 ,,	72 ,,
Carbohydrates	95 ,,	97 ,,

Shaw agrees with Kellner in suggesting 20 to 30 lb. per head per day for milch cows, or smaller amounts if fed with maize, and states that from 10 lb. downward may be fed per head per day to calves, and from 10 lb. upward for young cattle. Fattening cattle may be given much larger amounts.

Pigs.—Kellner gives the following comparison between the digestible constituents of sugar beets and mangolds for pigs:—

	Mangolds.	*Sugar Beets.*
Organic substances	90 per cent.	95 per cent.
Crude protein	58 ,,	52 ,,
Carbohydrates	96 ,,	99 ,,

Experiments in the United States † have shown that 1 lb. of barley can be replaced by from 4 to 8 lb. of sugar beets for pigs.

Sheep.—An experiment carried out in Michigan † showed that 100 lb. gain in live weight was produced by 4,900 lb. sugar beets and 1,018 lb. hay. Shaw* is of opinion that sugar beets along with hay form too bulky a food for sheep, and advises feeding with grain, this latter ration being excellent for breeding ewes, and for fattening sheep and lambs.

---

* *Feeding Farm Animals* (Shaw).

† *Michigan Expt. Sta.*, Bull. 128.

BEET LEAVES AND TOPS.—It has been found that many of the mineral salts in the root retard the crystallisation of sugar in the manufacturing processes and increase the production of molasses, and as these salts accumulate in greater quantities in the crown of the root than elsewhere, this part has to be removed with the leaves.

Opinions vary as to the advisability of feeding the leaves and tops to stock. They contain so much valuable fertilising substance that the land is impoverished by a crop of sugar beets unless the tops and leaves are left on the land or ploughed under, or unless they are fed to stock on the land. The following is given by Kellner as the composition of the leaves and tops, dry:—*Crude nutrients:*—water, 14·0 per cent.; crude protein, 9·1 per cent.; crude fat, 0·8 per cent.; nitrogen-free-extract substances, 34·8 per cent.; crude fibre, 11·1 per cent.; ash, 30·2 per cent. *Digestible nutrients:*—crude protein, 3·8 per cent.; crude fat, 0·2 per cent.; nitrogen-free-extract substances, 28·4 per cent.; crude fibre, 7·5 per cent. *Availability,* 81, *digestible protein,* 1·8 per cent., *starch equivalent,* 27·0. Among the soluble mineral substances is oxalic acid (3–4 per cent. of the dry matter), which "may be consumed by stock in small quantities without any ill effects, but increased amounts cause symptoms of poisoning, and may lead to death. Generally, oxalic acid undergoes partial fermentation in the first stomach of ruminants, but in pigs and horses this preventive arrangement fails. It is, therefore, advisable to give some carbonate of lime along with the beet tops to render the oxalic acid insoluble. On an average, ¼ lb. of chalk may be given to 250 lb. of leaves.

"The leaves have, in any form, a loosening effect on the bowels, and should, therefore, be given along with straw or hay. A third of the total ration of a dairy cow might be

---

[*] *Feeding Farm Animals* (Shaw).

composed of these leaves, whilst a fattening bullock could be given more. The earth, which often adheres in large amounts to the leaves and heads, should always be washed off." *

There are various methods of feeding the tops and leaves. Cattle and sheep may be turned into the fields immediately after the roots have been removed, and before the tops have had time to dry. The tops and leaves may also be allowed to dry on the ground as in the case of hay, when they lose about 50 per cent. of their water. Townshend † gives the average yield of dry material from one acre as about 1 ton, and states that when drying is carried out by machinery it is considered equal in value to the same quantity of first-class hay. The tops may also be made into silage with advantage, the best plan being to place them in alternate layers with some dry material like straw, which will take up the excessive moisture from the leaves. About 6 to 8 lb. of salt per ton of leaves should be sprinkled over the layers. This mixture, if properly treated, is stated to keep for several years, and is considered very satisfactory by dairymen.

When the tops and leaves are fed green, they should be chopped small, as animals, especially sheep, have some difficulty in swallowing tops whole.

Susceptibility of Various *Cruciferæ* to Finger-and-Toe Disease.

It is stated in the Board's Leaflet No. 77 that finger-and-toe disease (*Plasmodiophora brassicæ*, Woronin) attacks most, if not all, crops belonging to the order *Cruciferæ*, such as turnips, swedes, cabbages, kohl-rabi, rape, and radishes. Experiments recently carried out by the Agricultural Experiment Station at Vermont ‡ in this connection have shown that there is a wide range of susceptibility to this disease among the *Cruciferæ*, not only among the different genera, but among the species within the genera, and to an equal extent among the different varieties of the same species.

---

* *Scientific Feeding of Animals* (*Kellner*).

† *Year-book of the U.S. Department of Agriculture*, 1908, p. 444.

‡ The Comparative Susceptibility of Cruciferous Plants to *Plasmodiophora brassicæ*. G. C. Cunningham, *Phytopathology*, Vol. II., No. 4.

The experiments were carried out on land on which cabbages had been grown commercially for a number of years, but which had become so badly infected with finger-and-toe that such plants could no longer be profitably raised. As many species of crucifers as possible were obtained from various sources and sown upon the infected soil, each species of seed being sown in several different parts of the field, so that by averaging the results the factor of variations in soil conditions was reduced to a minimum. The following table shows the comparative susceptibility of the thirteen varieties of cabbages tested.

Variety of Cabbage.	*Number Examined.*	*Percentage Diseased.*	*Percentage badly Diseased.*
Mammoth Rock Red	275	100	97·1
Perfection Savoy	279	100	92·5
American Savoy	249	99·2	80·0
Dark Red Erfurt	238	98·8	86·6
All Seasons	654	97·3	88·8
Henderson's Early Summer	356	94·4	72·0
Early Winningstadt	339	94·4	63·7
Charleston	304	94·1	74·6
Volga	546	91·2	82·0
Early Jersey Wakefield	274	90·6	47·5
Large Late Flat Dutch	486	90·1	62·6
Stone Mason	180	85·6	65·6
Hollander	541	73·5	52·6

A large number of other crucifers were tested, and the following table shows some of the results:—

Name.	*Percentage Diseased.*	*Percentage badly Diseased.*
Cauliflower (*Brassica oleracea*, var. *botrytis*)	100	100
White mustard (*B. alba*)	100	100
Charlock (*B. arvensis*)	100	100
Kohl-rabi (*B. oleracea*, var. *caulo-rapa*)	95·3	79·7
Penny Cress (*Thlaspi arvense*)	94·5	86·1
Cabbage (*B. oleracea*, var. *capitata*)	93·1	74·4
Collards (*B. oleracea*, var. *acephala*)	92·8	66·1
Brussels sprouts (*B. oleracea*, var. *gemmifera*)	86·4	86·4
Rape (*B. napus*)	83·7	32·5
Round black Spanish radish (*Raphanus sativus*)	65·9	56·1
Shepherd's Purse (*Capsella bursa-pastoris*)	57·3	57·3
Everlasting radish (*Raphanus sativus*)	53·8	0
White tip radish (*R. sativus*)	46	35·4
Giant radish (*R. sativus*)	16·9	11·3
Cultivated turnips (*B. campestris*)	12	5·2
Pepperwort (*Lepidium campestre*)	38·6	21·1
Arabis alpina	52·4	9·6
Neslia paniculata	100	100

The wide range of susceptibility among the species and varieties leads to the hope that varieties of cabbages, turnips, and radishes may be found more resistant to finger-and-toe disease than those commonly cultivated.

Gorse, Furze, or Whins as a Forage Crop.

GORSE is usually regarded as an undesirable plant, or at best is tolerated in situations where better plants do not readily grow, but in some parts of the United Kingdom, notably in Wales and Ireland, and also in France, particularly in Brittany, it is regarded as a useful forage crop, and is specially cultivated as such.* Even in these cases, though occasionally grown on quite good agricultural land, it is more commonly cultivated on poorer soils, as, on such, if somewhat dry and sandy, it is more permanent and suffers less from the competition of grasses and weeds. When a field is to be cropped with the plant the seed is sown along with the corn crop in the same way as clover or grass seeds. The seed is usually sown broadcast at the rate of 25 to 35 lb. per acre, and the plants should come up very thickly so as not to assume the bushy character typical of isolated specimens.

The crop is generally cut every two years (cutting annually tends to weaken it too much), and it is thus usual to have two pieces of ground under the crop, cut in alternate years. Cutting begins, as a rule, in November and continues through the winter. No more than the quantity sufficient for one or two days' requirements is harvested at once, so that the stock receive it in a fresh, succulent condition, and to a great extent it takes the place of roots in winter feeding. Cutting is effected by hook or slasher, and the gorse is prepared for food by being chaffed with a special type of chaff-cutter, afterwards being bruised in a special mill, or even by hand. Sometimes a combined cutter and bruiser is used, in other cases the bruising is omitted; even in this case, adult stock, after having once acquired a taste for the food, take it readily, only leaving the very hard, woody parts. It is regarded as particularly suitable for horses and milch cows, and horses, maintained upon it almost wholly during the winter, keep in excellent condition.

In the "Encyclopédie Agricole" the following analysis of the forage is quoted from M. A. C. Girard:—

---

* See *Journal*, Dec. 1911, p. 759.

Water	52·67 per cent.
Albuminoids	4·49 ,,
Amides	0·27 ,,
Fat	0·9 ,,
Carbohydrates	25·78 ,,
Crude Fibre	14·32 ,,
Ash	1·57 ,,

The same authority states that its digestibility is much higher than would be thought from its appearance. In experiments upon the horse the following coefficients of digestibility were obtained:—Carbohydrates 53·8 per cent., Fibre 33·1 per cent., Crude Albuminoids 51·8 per cent., and Fat 57·7 per cent.

Another French authority suggests that 250 lb. of fresh gorse is equal to about 100 lb. of hay. The quantity fed varies very much; from 20 lb. to 40 lb. per day would be regarded as average limits for adult cattle or horses.

The crop has doubtless a considerable value on poor, dry soils, as supplying succulent and nutritious forage in winter, though, except in special cases, there is no reason to recommend that the cultivation of the crop should be extended. On ordinary soils, crops equally productive and more convenient, can be readily obtained.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

MANURING AND TREATMENT OF PERMANENT GRASS.

Manures for Permanent Pasture (*Northumberland County Educ. Com., Guide to Experiments at Agri. Expt. Sta., Cockle Park,* 1912).—Plots were laid down in the "Tree Field" in 1897 to test different systems of manuring pasture, the improvement being measured by the increase in the live weight of sheep grazing the plots, and by the weight of hay obtained from a small portion ($\frac{1}{20}$ acre) reserved for mowing. Each plot is 3$\frac{1}{20}$ acres in extent, and the treatment for the first nine years (1897–1905) is given below, together with the annual gain or loss as a result of the treatment. A second scheme of treatment was carried out on the same plots for the years 1906–1911, particulars of which are also given. The quantities, costs, &c., are per acre, and in arriving at the gain in the second scheme no allowance has been made for the cost, or any unexhausted effect, of the treatment given in the first nine years of the experiment.

The gain or loss per acre is arrived at by valuing at 3*d.* a lb. the extra increase in live weight of the sheep on any plot, as compared with the untreated plot 6, and deducting the cost of manure or cake.

---

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Plot.	Treatment and its total cost for 9 years, 1897–1905.		Average annual gain or loss (−)	Treatment and its total cost for 6 years, 1906–11.		Average annual gain or loss (−) in the 6 years.
	Treatment.	Cost.		Treatment.	Cost.	
1	Dec. Cott. Cake fed on plot: 597 lb. in 1897–8, again 1903, and again 1904 ...	132/-	2/9	600 lb. Dec. Cott. Cake fed annually, 1906–1908	132/6	9*d.*
2	Common Lime: 4 tons 1897, and again 1903	100/-	−9/4	No further treatment	—	6/-
3	Basic Slag: 10 cwt. 1897	24/4	17/4	Basic Slag, 10 cwt. 1906	24/4	19/5
4	Basic Slag: 5 cwt. 1897, and again 1900	24/4	13/10	Basic Slag: 5 cwt. 1906, and again 1909	24/4	15/2
5	Superphosphate: 7½ cwt. 1897, and again 1900	40/2	9/9	Slag, as on plot 4...	24/4	15/7
6	No treatment	—	—	No treatment... ...	—	—
7	Super., as on plot 5, and Sul. of Potash 100 lb. 1897, again 1899, and again 1903	68/11	8/9	Slag, as on plot 4: 100 lb. mur. potash, repeated 1909	40/6	12/3
8	Super., as on plot 5: ground lime 10 cwt. 1897, again 1899, and again, 1903 ...	72/5	11/8	Slag, as on plot 4: 1 ton common lime, 1906, repeated 1909 ...	49/4	13/-
9	Super., as on plot 5: Sul. of Amm. 84 lb. 1897, again 1899 again 1900, and again 1903	79/11	4/7	Slag, as on plot 4: 139 lb. Nitrate of Soda, repeated 1909	49/2	9/4
10	Dissolved Bones: 6 cwt. 1897, and again 1900	72/-	7/4	Dissolved Bones: 564 lb., repeated 1909	60/5	4/3

The change that has been effected on some of the plots by the treatment is shown by the following summary of the botanical analyses of the herbage during the five years 1907–11:—

Plots	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Percentage of Grasses in Herbage ...	93·3	90·4	82·6	86·0	78·0	90·6	79·4	79·8	80·6	82·2
Percentage of Clovers and allied plants in Herbage	4·2	6·8	14·6	8·8	17·4	2·2	16·0	13·6	15·4	9·2
Percentage of Weeds in Herbage ...	2·6	2·8	2·8	5·2	4·6	7·2	6·4	6·6	4·0	7·4

The most striking results of the six years of the second scheme are:—

(1) The excellent effect of the third and fourth dressings of 5 cwt. of basic slag per acre on plot 4 in 1906 and 1909.

(2) The bad effects of nitrate of soda on plot 9. On plot 5 the annual gain per acre from slag alone is 15*s.* 7*d.*; on plot 9 the addition of nitrate of soda has reduced the average annual gain to 9*s.* 4*d.*

(3) A potash manure is still unprofitable on the poor clay soil (compare plots 5 and 7).

(4) The average annual gain from the feeding of decorticated cotton cake is only 9*d*. an acre. Nitrogen from the cake has had the same effect on the herbage as nitrogen from the active nitrogenous manures, and the herbage is still of a coarse and benty character.

(5) The third and fourth dressings of dissolved bones have given a poor return when compared with slag.

(6) Lime in conjunction with slag has not given profitable results (compare plots 5 and 8).

(7) A dressing of 10 cwt. of slag per acre, given at the commencement of the six years has been on the average more profitable to the extent of 4*s*. 3*d*. per acre per annum than the same amount of slag applied in two dressings (compare plots 3 and 4).

Eradication of Moss (*Cornwall C.C., Rept. on Agric. Expts.,* 1911; *Mr. W. Hawk*).—Experiments commenced in 1902 have shown that 6 cwt. per acre of superphosphate applied about the end of February will destroy moss in pastures. In exceptional cases, where there is a dense carpet of moss, a similar application may be required the following season. Apparently the destructive effect is due to the acidity of the superphosphate, as has been demonstrated by a series of plots manured as follows:—

Plot 1.—6 cwt. superphosphate and 6 cwt. fine bone meal applied separately.

Plot 2.—6 cwt. superphosphate and 6 cwt. fine bone meal applied at the same time as the manures on plot 1, but mixed three months before.

Plot 3.—6 cwt. basic superphosphate.

Plot 4.—6 cwt. superphosphate.

On plots 1 and 4 the moss turned brown in from a week to ten days after the application of the manures, while on plot 2 no appreciable effect could be observed until late in the autumn of the second year. In the case of plot 2 the acid of the superphosphate had been neutralised by the bone meal.

Close observation has shown on several occasions that on plot 1 the acidity so affects the carpet of moss, which has often stood from 2 to 3 in. high on the poor pasture upon which the experiments have been conducted, that the manure soon reaches the soil below and takes effect. On plot 2, on the other hand, the manure, which may be seen lying upon the carpet of moss, months after it has been applied, is powerless to either injure the moss or to reach the soil below.

An experiment is now in progress to determine if moss can be eradicated by suitable stocking of the pasture. Two plots are laid out in one field. One plot is grazed closely in late summer or early autumn; the other is not pastured until well into autumn, when the grass has grown fairly luxuriantly. On the first plot the moss grows freely; on the other it has been crowded out by the growth of grass.

Manuring of Meadow Hay (*Grass Manuring Experiments at Kineton, Warwickshire, Report for* 1912; *Mr. Ernest Parke and Dr. B. Dyer*).—Experiments on the manuring of meadow hay have been carried on in two fields for the last eleven seasons. The plan of the experiment, the weight of hay obtained in one of the fields in 1912, and the average results for the eleven seasons are given below:—

"FIVE AND THREE ACRES."

Plot.	Annual manuring (since 1905) per acre.	Weight of Hay, 1912. Cwt.	Average weight of Hay in eleven years.
1.	No Manure	14½	11
2.	3 cwt. Superphosphate	32	30½
3.	3 cwt. Superphosphate 1 cwt. Sulphate of Potash	34½	31½
4.	3 cwt. Superphosphate 1½ cwt. Nitrate of Soda	41½	39½
5.	3 cwt. Superphosphate 1½ cwt. Nitrate of Soda 1 cwt. Sulphate of Potash	42	40
6.	1½ cwt. Nitrate of Soda	26	29½

In the other field, where the soil was heavier and deficient in lime, basic slag was used instead of superphosphate; otherwise the plan of the manuring was the same, and the effects have been almost exactly identical.

The striking feature of the experiments is the increase in crop due to phosphates and nitrogenous manures. Potash, though often required, is not needed on the heavy soils on which the experiments were carried out. No botanical analysis of the herbage has been made, but the unmanured land is conspicuous for its poor wiry grass and abundance of weeds. Phosphates and potash alone have strongly encouraged leguminous plants, but it is considered that the best herbage is that found on the plots receiving both phosphate and nitrate each year.

FEEDING STUFFS.

Probable Error in Pig-feeding Trials (*Journal of Agricultural Science, October, 1912; Mr. G. W. Robinson and Mr. E. T. Hulnan, School of Agriculture, Cambridge*).—As a necessary preliminary to a series of pig-feeding experiments which are in contemplation, attempts were made to ascertain from published results of previous trials the probable error. It was found, however, that the results available for examination were so few that special trials were carried out for the express purpose of determining the probable error of a pig-feeding experiment. Eighteen pigs, about ten weeks old, were housed in sets of three, and all fed alike on an *ad libitum* ration of sharps and barley meal mixed into a slop with water. All the pigs were of the large white breed, and were practically uniform in weight and age.

Except in the case of five pigs, which were not obtained till August 7th, the animals were put under experiment on July 31st, and they were weighed on July 31st, August 7th, August 26th, and afterwards at intervals of four weeks, the last weighing being on November 21st. Two pigs died during the experiment from causes which had nothing to do with the conditions of the experiment.

Using the method of least squares, it was found that: (1) for the whole number of pigs for the complete period the probable error of one animal was 8 per cent. of the average live-weight increase; (2) for the whole number of pigs the probable error of one animal in the intervals between the weighings was as follows:—

(a)	18 pigs for	3 weeks	21·6 per cent. of average live weight increase
(b)	17 ,,	4 ,,	11 ,, ,, ,,
(c)	17 ,,	4 ,,	13·4 ,, ,, ,,
(d)	16 ,,	4 ,,	9·6 ,, ,, ,,

The error, therefore, while greater than that for the whole period, tends to diminish as the pigs get older; (3) for the eleven pigs which survived out of the original thirteen the probable error of one animal was 7·0 per cent. of the average increase; (4) in the same way as in (2) the probable error of one animal was as follows:—

(a)	13 pigs for	4 weeks	15·7 per cent. of the average live weight increase
(b)	12 ,,	4 ,,	11·2 ,, ,, ,, ,,
(c)	12 ,,	4 ,,	13·8 ,, ,, ,, ,,
(d)	11 ,,	4 ,,	8·0 ,, ,, ,, ,,

Again the error diminishes as the animals get older.

It will be seen that the probable errors calculated in (3) and (4) are little less than those in (1) and (2), showing that accuracy is not greatly increased by uniformity in weight among the animals under experiment. Uniformity of breed, however, appears to be very important. From the results of these experiments and those obtained from experiments conducted by the West of Scotland Agricultural College and by the Wisconsin Experimental Station, it appears that the probable error of one animal in a pig-feeding experiment is about 10 per cent. of the average live-weight increase. The error is greater if the experimental period is short, and it is suggested that a period of twelve weeks is the shortest consistent with accuracy.

A table is given showing the number of animals which ought to be taken to show up varying differences with precision. For example, if two methods of feeding, which may be expected to show a 10 per cent. difference, are to be compared, each lot of animals should number not less than fifteen. If the results of the two methods of feeding are expected to differ by as little as 5 per cent., fifty-four animals should be included in each lot.

Feeding Value of Wheat Offals (Criblon) (*Die landw. Versuchs Stationen, Band lxxviii., Heft iii.* u. *iv.*).—A feeding stuff known as "criblon," consisting of the screenings of wheat from S.E. Europe and S. Russia, and containing broken and small wheat seeds, various weed seeds, and inorganic impurities, is used in some parts of Germany, especially for dairy cattle. Some millers in Germany make a practice of mixing it with other milling offals, such as bran and sharps, while others sell it separately.

The composition of the "criblon" apparently varies greatly; thus two commercial samples investigated contained: (1) 76·8 per cent. of broken wheat seeds, 22 per cent. of weed seeds, and 1·2 per cent. stones; and (2) 16·2 per cent. broken wheat seeds and 83·8 per cent. of weed seeds. The average composition of five samples taken in 1910 was: broken wheat seeds, 50·5 per cent., weed seeds, 43·9 per cent., inorganic impurities, 5·6 per cent. Altogether fifty-two different kinds of weed seeds were found, those present in large quantities being *Polygonum Convolvulus, Agrostemma Githago, Sinapis arvensis,* and *Saponaria Vaccaria.* Among the weed seeds were found many that were likely to have a harmful effect on the health of animals to which they were fed. The average chemical composition of the five samples was as follows:—Water, 11·04 per cent.; protein, 14 per cent.; fat, 3 per cent.;

N.free extract substances, 58·83 per cent.; fibre, 4·49 per cent.; ash, 8·64 per cent.; inorganic impurities, 5·6 per cent. From the chemical analysis, therefore, criblon would seem to be quite a suitable feeding stuff.

Reports are quoted showing the "criblon" to have a very favourable effect on milk secretion, as well as on the production of flesh, but in many cases it has had very detrimental effects on the health of animals. It is advised, therefore, that great caution should be exercised in purchasing.

It is also pointed out that there is a great danger of the weed seeds passing with their vitality unaffected into the manure of the animal, and thus infecting fields.

Composition and Feeding Value of Weed Seeds (*Die. landw. Versuchs Stationen, Band lxxviii., Heft iii.* u. *iv.*).—In connection with the preceding experiment, information was collected as to the chemical composition and feeding value of various weed seeds as found in wheat offals.

The seeds examined were those of black bindweed (*Polygonum Convolvulus*), corn cockle (*Agrostemma Githago*), charlock (*Sinapis arvensis*), cleavers (*Galium aparine*), bindweed (*Convolvulus arvensis*), wild vetches (*Vicia hirsuta, V. sepium, V. angustifolia*), cow-weed (*Saponaria Vaccaria*), and *Erysimum orientale*.

The following were the weights of 100 whole seeds:—Black bindweed, 0·55 g.; corn cockle, 1·13 g.; charlock, 0·21 g.; cleavers, 0·05 g.; bindweed, 0·91 g.; *Vicia hirsuta*, 1·12 g.; *V. sepium*, 1·72 g.; *V. angustifolia*, 1·57 g.; *Saponaria Vaccaria*, 0·67 g.; *Erysimum orientale*, 0·28 g.

The following were found to be the chemical analyses:—

	Water.	Protein.	Fat.	Carbohydrates.	Crude Fibre.	Ash.
Black Bindweed	10·88	10·50	2·12	68·53	6·37	1·60
Corn Cockle	11·24	16·13	5·98	57·00	6·33	3·32
Charlock	7·27	28·25	28·18	22·87	9·63	3·80
Cleavers	9·75	11·25	4·20	64·42	6·58	3·80
Bindweed	10·32	18·50	6·00	47·58	14·05	3·55
V. hirsuta	11·44	27·25	0·65	52·36	5·58	2·72
V. sepium	10·44	29·88	0·82	49·96	6·00	2·90
V. angustifolia	9·45	30·75	0·74	49·82	6·47	2·77
Saponaria vaccaria	12·34	12·88	3·04	64·74	4·83	2·17
Erysimum orientale ...	8·50	27·25	28·25	25·00	6·90	4·10

The seed of black bindweed would seem to have the same feeding value as buckwheat, and there have been no unfavourable reports as to its suitability for animals. Corn cockle contains the poisonous substance *Githagin*, in amount varying from 6·44 to 7·70 per cent. Feeding experiments with the weed have had very varied results; thus Ulrich found that a sucking-pig weighing 9 kg. died in fourteen days after being fed from 20—100 g. of corn cockle meal per day, while a much heavier animal, given 350 g. of the meal per day remained quite healthy. In other experiments sucking calves given 6—7 g. of the seeds per day died in from 18 to 22 hours. In other experiments again, cows fed on bran mixed with the weed seeds aborted. On the other hand, many experimenters have obtained nothing but favourable results from feeding with corn cockle. It appears that the seeds can be rendered innocuous by roasting or by removing the husk and germ.

Minute quantities of oil of mustard are liable to be formed in the stomach of an animal as a result of feeding with charlock seeds, and it might be advisable to grind and cook before feeding. Many varieties of wild vetches contain amygdalin, from which prussic acid may be formed.

Feeding Value of Potato Haulm (*Bull. Bur. Agric. Int. and Pl. Dis.*, September, 1912).—In experiments conducted by Völtz at the Institute of Fermentation Industries, Berlin, potato haulm harvested early in October was dried partially in the field and later in drying kilns, and then chopped and fed to two wethers. The analysis of the dried tops was as follows:—Water, 19·83 per cent.; crude protein, 10·13 per cent.; carbohydrates, 28·71 per cent.; crude fat, 3·58 per cent.; crude fibre, 27·03 per cent.; ash, 10·72 per cent. The following were the coefficients of digestibility:—Crude protein, 61·2 per cent.; crude fat, 41·7 per cent.; crude fibre, 56·4 per cent.; carbohydrates, 76·9 per cent. The tops were found to have a greater digestibility when mixed with meadow hay.

The tops were eaten with avidity by the sheep, and no bad effects resulted.

DAIRYING.

The Cause of Wide Variation in Milk Production by Dairy Cows (*Univ. of Missouri, Agric. Expt. Sta., Research Bull. No. 2*).—It is often found that in a herd of ordinary size some cows will produce at least twice as much milk and butter-fat as other animals of the same age and breeding and having the same food and care. The importance of taking advantage of this wide variation has been emphasised in recent years, but the exact cause of the difference has not yet been ascertained. The investigation reported on was undertaken with a view to throwing light on this question, and was suggested by the fact that two cows in the college herd showed a striking difference in production. These cows were registered Jerseys, and were rather more than half-sisters, the sire being the same and the dams distantly related. Cow 27 produced her first calf when 29 months old. Cow 62 produced her first calf when 18 months old. Cow 27 in her first two lactation periods gave 4,552 lb. and 7,174 lb. of milk; Cow 62 gave 878 lb. and 3,189 lb. Taking the two years together, Cow 27 produced 2·8 lb. of milk and 3·9 lb. of fat for each pound produced by Cow 62. In order to prosecute the inquiry, the cows were served so that they should produce their third calves as nearly as possible at the same time, and they actually calved within three days of one another.

It was considered that the possible causes of the great difference in production were as follows:—

(1) Variation in the amount of food required for maintenance.

(2) Difference between the two animals in the ability to digest food consumed.

(3) The production of body fat by the inferior cow from a portion of the ration given in excess of the food required for maintenance.

(4) Difference in the amount of food consumed in excess of the ration of maintenance.

Experiments testing how far each of these four possible causes was responsible were carried out, and it was found:—(1) That there was a slight difference in the maintenance requirements of the two animals, but that this difference did not account in any way for the wide difference in the production of the two cows; in fact, Cow 27, the larger producer, had the higher maintenance requirements. (2) A digestion trial, carried out while the milk production of both cows was at its maximum, showed that there was very little difference between the two animals in the power to digest food. (3) In order to eliminate the effect of food being utilised to produce body fat, the ration of the two cows was adjusted so that both were kept at uniform weight. (4) As was expected, there were great differences in the weight of food consumed by the two cows and in the amount available for producing milk after the maintenance requirements had been satisfied. The figures in the two cases were as follows:—

Cow No. 27.

	Grain. lb.	Hay. lb.	Silage. lb.	Green Food. lb.
Consumed during year	3,424	2,904	8,778	4,325
Maintenance requirements for year	1,201	1,204	4,818	—
Available for milk production ...	2,223	1,700	3,960	4,325

Cow No. 62.

	Grain. lb.	Hay. lb.	Silage. lb.	Green Food. lb.
Consumed during year	1,907	1,698	5,088	2,102
Maintenance requirements for year	1,066	1,066	4,292	—
Available for milk production ...	841	632	796	2,102

A comparison of the two tables shows that for every pound of grain available for milk production by Cow 62, 2·64 lb. are available in the case of Cow 27. It was found that the milk and fat production of the two cows coincided almost exactly with this ratio, and it is concluded that *after the maintenance ration is deducted* in the two cases, Cow 62 produces fat and milk as economically as Cow 27. The difference in economy of production arises from the fact that the former requires the greater part of what she can digest to meet maintenance requirements (*i.e.*, supply of heat, energy, and of material to make good normal wear and tear), as is shown by the following table:—

	Proportion of ration used for maintenance purposes.	Proportion of ration used for milk production.
Cow 27	35·0 per cent.	65·0 per cent.
Cow 62	55·8 ,,	44·2 ,,

In a subsequent lactation period Cow 62 was given all the food she would eat to see how far this would affect the milk produced. It was found that there was no increase in the amount of milk as the food was increased, and the extra food was used in depositing fat on the body.

It is concluded that the real cause of the difference in production was found to be the ability to consume a large quantity of food in excess of the amount required for maintenance, and to use the excess of food thus supplied for milk production.

NOTES ON CO-OPERATION.

Pig Insurance Clubs in 1911.

THERE are in England and Wales more than a thousand Co-operative Societies for the mutual insurance of pigs, generally known as Pig Clubs, but only 32 of them are registered under the Friendly Societies Act, and statistics are not available for the remaining clubs, which are merely private associations of individuals without any legal standing as societies. There must be altogether nearly 50,000 members of such societies, and this form of co-operation has been one of the most popular and successful in this country, so far as agricultural interests are concerned. Almost all of these Pig Clubs consist chiefly of working-men, and have been started spontaneously without any help or impetus from outside. Each village has worked out its own ideas in the matter, so that there is a great variety in the rates and rules adopted, and it is interesting to compare them with one another, and to see what their general experience has been.

Registered Societies.

The registered societies are required to submit an annual return to the Registrar, and to have their rules examined by him. Even in their case the members have had little official guidance as to the system of working they should adopt, for the Registrar's duties are confined to satisfying himself that the rules are not inconsistent with the Act, and he is not responsible for seeing that the societies are established on a financially sound basis.

According to the Annual Returns of these 32 registered societies for the year 1911, the number of members was 1,694, the number of pigs insured 3,570, and the number on which claims were paid during the year 173, giving an average death-rate for the year of 4·8 per cent. The amount paid on claims after deducting the income from the sale of carcases was £306, the income from insurance contributions was £351, the total income of the insurance fund was £489, and the total expenditure £463. Thus there was a net saving in the year of £26, and the amount at credit of the insurance fund rose from £1,959 at the beginning of the year to £1,985 at its close. In these figures there are included those for the Calne Pig Insurance Association, the conditions of which are quite exceptional, and, seeing that that society insured 728 pigs, or more than one-fifth of the whole number, it will give a better idea of the working of the ordinary village pig clubs if the figures for that society are excluded from the total.

The other 31 societies are almost all comparatively small village clubs, confined to the residents in a single parish or in two or three adjoining parishes. The members are mainly working-men, often owning each only one pig. These 31 clubs had last year a total of 1,627 members, which gives an average of 52 members per club, but one club had only 14 members, and another had as many as 135. The total number of pigs insured in these clubs was 2,842, which gives an average of 92 pigs per club, but one club insured only 21 pigs and another as many as 287. The average of pigs per member was 1·7, but some clubs had an average of a little over one pig, and another of over 5 per member. Of the 2,842 pigs insured 119 died or were slaughtered in consequence of disease or accident during the year, so that claims had to be paid upon them; this gives an average death-rate for the year for these clubs of 4·2 per cent. In the previous year, of 1,928 pigs insured (excluding Calne), for which these statistics were available, 63 died, giving a death-rate of 3·3 per cent. for that year, so that in this respect the clubs have had a worse year than in 1910. Adding together the experience of the two years, we have on the average of 2,385 pigs insured in village clubs, a death-rate of 3·8 per cent. per annum.

The Death Rate.

Naturally the death-rate for different clubs differs greatly. For instance, in the year 1911, five societies, insuring altogether 350 pigs, had no losses at all; on the other hand, three of the larger societies had a death-rate exceeding 6 per cent., the highest being at Louth, with a death-rate of 8·7 per cent. The only safe way to estimate the probable average death-rate for a new society is to take the averages for a considerable period of years. This has been done for five societies, with the following results for a period of nine or ten years in each case:—

	Average number of pigs insured.	Average number of deaths in the year.	Average death-rate per cent. per annum.
Kemerton	97	0·9	0·9
Bredon	124	1·4	1·2
Aberford	66	2·3	3·5
Scawby	57	2·8	4·9
Hand-in-Hand, Spalding (Unregistered)	64	5·2	8·1
Total	408	12·6	3·1

To judge, therefore, from the experience of these societies, an ordinary village pig club may expect to have an average death-rate of less than 4 per cent. per annum, which may be reduced by good management to something like 1 per cent. per annum, and may be increased by lax administration or by the unhealthiness of the locality as much as 8 per cent. per annum.

As regards the amount which a club has to pay on the average on each pig that may die, it is necessary to take into account the system of working of the different clubs. Nineteen of the thirty-one clubs pay to the owner the full value of the pig at the time it fell ill, but a number of clubs pay him only a fraction of the value, varying from two-thirds to seven-eighths, the most common fraction being three-fourths, or 15*s.* in the £. In practically all clubs it is laid down in the rules that anything received for the carcase of an insured pig on which a claim is made will go to the credit of the club, and last year nine clubs received £53 for the carcases of 70 pigs on which claims were paid (an average of 15*s.* per carcase). Some of the better-managed clubs never sell a carcase, but do their best to cure the pig, and, if it dies, bury [illegible] and pay full compensation to the owner. In other clubs a practice has arisen of arranging for the sale of the sick pig, when it is saleable, and paying from the funds of the club; the difference between the amount received and the amount for which the animal is insured. The total amount paid in 1911 by all the 31 club was £308, and if from this be deducted the £53 received for carcasses, the net loss to the clubs on the death of 119 pigs was £255, giving an average loss of £2 3*s.* per pig that died, and of nearly 1*s.* 10*d.* per pig insured. (For the previous year the net loss per pig insured was 1*s.* 11*d.*)

The amount payable varies according to the value of the pig, and last year one club paid £6 5*s.*, and another as much as £8 5*s.*, on the loss of a single pig; but seeing that in 1910 the average loss per pig was £2 9*s.*, and that according to the ten years' experience of the five societies above-mentioned, the average loss per pig that died was £2 12*s.*, it appears that a well-managed village club in an ordinarily healthy locality may reckon on an average death-rate of not more than 4 per cent. per annum, and of having to pay on pigs that die an average of something like £2 10*s.* To cover such a risk it would be necessary to have an average net income from insurance contributions of 2*s.* per pig per annum.

Amount of Premiums Paid.

In the matter of insurance contributions, there is a great variety in the practice of the different clubs. The class of pig usually insured is the store-pig kept for fattening purposes, and most of the pigs insured in these village clubs are kept by the working-man member for the consumption of himself and his family. Such a pig is usually bought in spring, when it is from eight to ten weeks old, at a cost of from 10s. to £1, and is fed during the summer and autumn, and killed in the winter; it is thus in its owner's possession for about nine or ten months.

The usual practice of these clubs is to have a general meeting once a quarter, and to require each member to pay his subscriptions at the quarterly meeting; and in most clubs it is the rule, or at all events the practice, for a member to pay the full quarterly subscription for at least one pig, whether at the moment he has a pig in his possession or not; so that practically the insurance contribution is paid for the whole year. As regards store-pigs, it varies from 1*s.* to 6*s.* per annum, but the commonest rates are 2*s.*, 3*s.*, or 4*s.* In some clubs a member is required to pay 2*s.* per annum in any case, and 6*d.* additional for the insurance of one pig, and a further 1*s.* 6*d.* per pig for every pig, after the first, that he insures. In other clubs, again, it is the practice for a member to begin by paying, at the rate of 1*d.* per week, 4*s.* 4*d.* per annum for every store-pig insured, but when the amount at credit of the insurance fund exceeds a fixed limit, say £20 or £30, all insurance contributions cease as regards members of more than four years' standing, until the insurance fund again falls below a fixed limit. Again, as regards the insurance of breeding-sows and boars, there is a great difference of practice; some clubs refuse to insure any but store-pigs, others will not insure boars, but do insure sows. When a boar is insured, double the premium charged for a store-pig, is usually paid, the amount varying from 3*s.* to 8*s.* 8*d.* per annum. A similar charge is generally made for the insurance of a breeding-sow, but sometimes the plan adopted is to charge 2*s.* or 3*s.* extra each time the sow litters. Thus the actual realisations of insurance contribution per pig insured vary considerably from club to club; but for all the 31 clubs in 1911, the actual amount realised in insurance contributions was £316, which gives on the 2,842 pigs insured an average realisation under this head of 2*s.* 3*d.* per pig; and, seeing that, as above stated, the net loss per pig insured in that year was only 1*s.* 10*d.*, the insurance contributions were on the whole sufficient to meet the net losses and leave a useful margin of profit.

Special Contributions.

Nearly every club has in its rules a clause to the effect that should the funds available not be sufficient to meet the claims, the members will make up the necessary amount by imposing a special levy on themselves. A few clubs provide that no such levy will be made in the case of a general epidemic, and some others fix the amount of the levy, at, for instance, 1*s.* per month, or one quarter's subscription, or 6*d.* per member. As a matter of fact, only one of the registered clubs made such a levy in the year 1911, and the amount realised in this way was only £2 12*s.* (In 1910 no club made a levy.)

Entrance Fees.

Most of the clubs require an entrance fee to be paid in addition to the annual insurance contribution. A number of clubs make this charge per member, the rate being usually 1*s.*, but varying from 6*d.* to 3*s.*; other clubs make the charge per pig, at rates varying from 6*d.* to 2*s.*, but in most cases 1*s.* per store-pig. Those clubs which insure sows and boars usually require a larger entrance fee of from 2*s.* 6*d.* up to 5*s.* per animal. The total amount realised by these 31 clubs in entrance fees and fines during the year was £23.

Income and Expenditure.

There was during the year an income of £36 from interest on the invested funds, £23 from entrance fees and fines, £316 from premiums, and £23 from other sources, so that, including the £53 received from the sale of carcasses, the total income of the insurance funds of these clubs for the year was £450.

On the expenditure side of the insurance fund, besides the £308 paid on claims, there was a disbursement in dividends to members of £58, and in other payments of £46, including the costs of management of a number of clubs which irregularly charged those costs to the insurance fund. Thus the total expenditure of the insurance funds of these clubs for the year was £412, the net profit of the year was £38, and the amount at credit of the insurance funds rose during the year from £1,961 to £1,999. If three societies had not distributed £58 as dividend to members, the net profits of the working of the year would have been £96, equivalent to 21 per cent. of the total income of the year.

According to the Friendly Societies Act, the expenses of management ought to be kept in an account separate from that of the insurance fund, and for the 18 village clubs (excluding Calne) which followed this rule, the total income of the management fund amounted to £61, and the total expenditure to £50, the total sum at credit of the respective management funds at the end of the year being over £42. The income was chiefly made up of £43 received in contributions raised from members for expenses of management, the usual arrangement being that each members pays a small contribution for this purpose, varying from 2*d.* to 1*s.* per annum. Two clubs, however, charge 4*d.* per pig insured, which seems a fairer way of apportioning the costs of management between the different members. About half the expenditure goes to pay salaries, the cost under this heading varying from nothing at all in some clubs to £8 7*s.* in the case of Louth, where the total cost of management amounts to 1*s.* 4*d.* per pig insured, a very high rate. On the average of the 18 clubs which keep a separate account of the costs of management, they amounted to £50 on 1,598 pigs, which gives an average of 7½*d.* per pig insured.

Thus, for these 31 clubs, taken together, the insurance funds showed a balance at credit at the end of the year of £1,999, and the management funds showed a credit balance of £42, making a total of £2,041. No society had any outside liabilities, and their assets were represented by £123 held as cash in hand, and £1,918 deposited in savings banks, on which the societies received interest at the rate of 2½ per cent. per annum. As the insurance contract expires at the end of each quarter, this sum of £2,041 is the unencumbered property of the societies, and represents the savings of past years. Taken by itself, it amounts to more than 14*s.* per pig insured, and would be sufficient to pay eight times the losses of the year. Every society shows a balance to its credit, the largest amount being £177, held by the Kemerton Society, which is equivalent to nearly £1 12*s.* per pig insured. But to judge by this standard, the club in the safest position is Scawby, with assets of £138 on 75 pigs, giving an average of £1 17*s.* per pig insured. These assets the societies owe practically entirely to their own good management, as the subscriptions and donations of honorary members amounted only to £19 for the year in seven clubs. It is perhaps more than a mere coincidence that the two clubs which have benefited most from the subscriptions of honorary members, show the highest average death-rate.

Utilisation of Reserve Fund.

As already said, three of the clubs utilise their savings to grant a dividend to their members; one club provides in its rules that the members shall pay 6*s.* a year per pig, and that every year a dividend shall be made of the funds in excess of £10. Last year it realised £58 from its members as insurance contributions, paid only £2 1*s.* 4*d.* on pigs that died, and returned £52 to its members in the form of dividend—a system which must have involved a great deal of unnecessary collection and disbursement of funds. Other clubs more wisely provide that when the balance at the credit of the insurance fund exceeds a certain amount, generally about £30, all members of more than four years' standing shall cease to pay insurance contributions until the balance at credit falls below, say, £20. The working

STATISTICS OF REGISTERED PIG INSURANCE SOCIETIES FOR 1911.

Serial number.	Name of Society.	County.	Year of Registration.	Number of Members.	Number of Pigs Insured.	Number of Pigs on which Claims were Paid during the Year.	Insurance Fund. Amount at the beginning of the year.	Insurance Fund. Income. Insurance Contributions.	Insurance Fund. Income. Entrance Fees and Fines.	Insurance Fund. Income. Interest.	Insurance Fund. Income. Sales of Pigs and Carcasses.	Insurance Fund. Income. Total Income.	Serial number.
							£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	
1	Langworth	Lincoln	1859	38	61	5	39 17	7 9	—	1 0	—	8 9	1
2	Kirton in Lindsey	Lincoln	1862	57	94	6	71 13	11 8	1 8	1 17	—	14 13	2
3	Conisborough	York...	1863	23	41	4	20 16	6 3	0 9	0 8	—	7 0	3
4	Aberford	York...	1865	82	82	None	13 14	5 11	1 7	—	—	7 2	4
5	First Billinghay	Lincoln	1865	54	84	1	89 2	10 12	3 4	2 3	—	15 19	5
6	Bucknall	Lincoln	1866	27	51	4	45 5	3 15	0 8	0 17	—	5 0	6
7	Nocton	Lincoln	1866	21	37	2	23 2	5 18	0 4	—	—	7 12	7
8	Bardney	Lincoln	1866	31	44	5	15 19	10 3	—	—	6 11	16 14	8
9	Scawby	Lincoln	1870	45	75	2	131 4	6 7	0 6	3 6	—	10 0	9
10	Hugglescote	Leicester	1872	87	87	1	10 0	58 5	—	—	—	58 5	10
11	Blankney	Lincoln	1873	18	27	1	93 11	—	—	2 6	—	2 6	11
12	Bredon	Worcester ...	1878	94	144	1	147 18	8 4	—	—	—	8 4	12
13	Werrington	Northampton ...	1878	135	287	16	124 13	16 14	—	2 16	9 0	32 19	13
14	Caistor	Lincoln	1881	35	56	2	53 2	12 6	—	1 2	3 17	17 5	14
15	Sutterton	Lincoln	1881	84	126	8	149 15	19 14	1 10	3 6	3 12	28 2	15
16	Eckington	Worcester ...	1886	36	46	1	68 14	4 14	0 13	1 13	—	7 0	16
17	Kemerton...	Gloucester ...	1887	86	112	2	176 2	7 10	1 2	4 5	—	13 1	17
18	Crowland	Lincoln	1887	74	130	6	6 11	22 0	0 10	—	3 0	25 10	18
	Carried forward ...	—	—	1027	1584	67	1280 18	216 13	11 1	24 19	26 0	285 1	

STATISTICS OF REGISTERED PIG INSURANCE SOCIETIES FOR 1911 (*continued*).

Serial number.	Name of Society.	County.	Insurance Fund.				Management Fund.				Assets.		Serial number.
			Expenditure.			Amount at the end of the Year.	Income.		Expenditure.		Deposits in Bank.	Total Assets.	
			Paid on Claims.	Dividend to Members.	Total Payments.		Contributions and Levies.	Total Income.	Salaries.	Total Expenditure.			
			£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	
1	Langworth	Lincoln	9 4	—	9 4	39 2	1 17	2 18	1 10	1 18	40 11	40 11	1
2	Kirton in Lindsey	Lincoln	13 14	—	13 14	72 12	—	2 9	1 10	1 15	73 6	83 3	2
3	Conisborough	York	8 3	—	10 3	17 13	—	—	—	—	16 19	17 13	3
4	Aberford	York	—	—	1 1	19 15	—	—	—	—	19 0	19 15	4
5	First Billinghay	Lincoln	6 5	—	9 18	95 3	—	—	—	—	91 17	95 3	5
6	Bucknall	Lincoln	16 14	—	16 14	33 11	2 18	2 19	0 10	2 9	33 8	34 1	6
7	Nocton	Lincoln	4 12	—	8 1	22 13	—	—	—	—	20 6	22 14	7
8	Bardney	Lincoln	14 19	—	14 19	17 14	1 15	1 15	1 5	2 1	—	14 2	8
9	Scawby	Lincoln ...	2 14	—	2 14	138 10	—	—	—	—	138 10	138 10	9
10	Hugglescote	Leicester	2 1	51 18	58 5	10 0	—	—	—	—	10 0	10 0	10
11	Blankney	Lincoln	2 3	—	2 16	93 1	2 18	4 18	1 0	1 15	93 9	96 4	11
12	Bredon	Worcester ...	5 0	—	5 0	151 2	2 16	4 3	2 8	3 2	150 0	153 16	12
13	Werrington	Northampton ...	29 11	—	31 15	125 17	2 16	5 13	2 6	5 13	120 14	125 18	13
14	Caistor	Lincoln	6 9	4 18	11 7	59 0	2 13	3 16	2 10	3 18	51 3	62 13	14
15	Sutterton	Lincoln	27 18	—	31 9	146 8	—	—	—	—	142 2	146 8	15
16	Eckington	Worcester ...	5 0	—	5 0	70 14	1 6	1 8	0 12	2 14	67 2	73 0	16
17	Kemerton...	Gloucester ..	12 5	—	12 5	176 18	2 16	2 16	1 5	2 6	177 7	177 7	17
18	Crowland...	Lincoln	18 13	—	24 8	7 13	—	—	—	—	6 14	7 14	18
	Carried forward ...	—	185 5	56 16	268 13	1297 6	21 15	32 15	14 16	27 11	1252 8	1318 12	

STATISTICS OF REGISTERED PIG INSURANCE SOCIETIES FOR 1911 (*continued*).

Serial number.	Name of Society.	County.	Year of Registration.	Number of Members.	Number of Pigs Insured.	Number of Pigs on which Claims were Paid during the Year.	Insurance Fund. Amount at the beginning of the Year.	Income. Insurance Contributions.	Income. Entrance Fees and Fines.	Income. Interest.	Income. Sales of Pigs and Carcasses.	Income. Total Income.	Serial number.
							£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	
	Bt. forward	—	—	1027	1584	67	1280 18	216 13	11 1	24 19	26 0	285 1	
19	Billinghay and district ...	Lincoln	1888	68	125	6	60 6	14 13	1 4	—	2 0	17 17	19
20	Walcot	Lincoln	1889	35	45	1	62 7	3 8	—	1 9	1 0	6 17	20
21	Old Fletton	Huntingdon ...	1890	72	212	7	72 19	8 14	5 6	1 13	—	17 2	21
22	Amber Hill	Lincoln	1890	14	22	1	20 0	4 5	0 14	0 11	—	5 10	22
23	Beckford	Gloucester ...	1890	33	46	2	65 0	1 17	0 4	1 9	—	3 10	23
24	Louth	Lincoln	1891	98	184	16	128 19	10 6	1 2	3 2	15 0	35 17	24
25	Horsington Victoria ...	Lincoln	1891	20	35	None	7 18	1 18	0 3	0 5	—	2 6	25
26	Stanway	Gloucester ...	1894	59	127	None	60 13	8 11	0 9	1 6	—	10 6	26
27	Winchcombe	Gloucester ...	1904	30	58	None	35 13	4 15	0 2	—	—	4 17	27
28	Kingsthorpe	Northampton ...	1906	89	178	8	107 12	10 3	1 14	—	—	12 8	28
29	Dumbleton	Gloucester ...	1906	34	48	None	17 17	5 5	0 13	—	—	8 2	29
30	Calne	Wiltshire	1906	67	728	54	−1 14	35 6	—	—	—	39 7	30
31	Cobholm	Norfolk	1910	30	157	10	40 16	11 8	—	1 1	8 14	26 1	31
32	Alderton	Gloucester ...	1911	18	21	1	—	14 2	—	—	—	14 2	32
	Total for 32 Societies...	—	—	1694	3570	173	1959 4	351 4	22 12	35 15	52 14	489 3	
	Total for 31 Societies... (omitting Calne)	—	—	1627	2842	119	1960 18	315 18	22 12	35 15	52 14	449 16	

STATISTICS OF REGISTERED PIG INSURANCE SOCIETIES FOR 1911 (*continued*).

Serial number.	Name of Society.	County.	Insurance Fund.				Management Fund.				Assets.		Serial number.
			Expenditure.			Amount at the end of the Year.	Income.		Expenditure.		Deposits in Bank.	Total Assets.	
			Paid on Claims.	Dividend to Members.	Total Payments.		Contributions and Levies.	Total Income.	Salaries.	Total Expenditure.			
			£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	
	Bt. forward ...		185 5	56 16	268 13	1297 6	21 15	32 15	14 16	27 11	1252 8	1318 12	
19	Billinghay and district ...	Lincoln	14 18	—	20 8	57 15	—	—	—	—	57 15	57 15	19
20	Walcot	Lincoln	2 15	—	5 14	63 10	—	—	—	—	60 4	63 10	20
21	Old Fletton	Huntingdon ...	9 16	—	13 10	76 11	—	—	—	—	72 10	76 11	21
22	Amber Hill	Lincoln	3 10	1 7	5 10	20 0	—	—	—	—	20 0	20 0	22
23	Beckford	Gloucester ...	6 0	—	6 0	62 10	1 0	1 0	0 6	1 4	62 10	62 18	23
24	Louth	Lincoln	35 14	—	35 14	129 2	12 13	14 6	8 7	12 6	129 16	142 2	24
25	Horsington Victoria ...	Lincoln	—	—	—	10 4	0 5	0 6	—	0 4	9 7	10 15	25
26	Stanway	Gloucester ...	—	—	2 10	68 9	2 0	4 18	1 0	4 10	59 9	69 16	26
27	Winchcombe	Gloucester ...	—	—	—	40 10	0 17	1 5	1 0	1 14	36 13	41 4	27
28	Kingsthorpe	Northampton ...	22 19	—	26 3	93 17	—	—	—	—	82 1	93 17	28
29	Dumbleton	Gloucester ...	—	—	1 3	24 16	1 0	1 7	—	0 8	17 12	26 12	29
30	Calne	Wiltshire	51 4	—	51 4	−13 11	8 19	9 10	5 0	11 7	—	9 12	30
31	Cobholm	Norfolk	24 8	—	24 8	42 9	2 6	2 6	—	2 8	43 11	43 11	31
32	Alderton	Gloucester ...	2 10	—	2 10	11 12	1 12	2 12	—	0 2	14 2	14 2	32
	Total for 32 Societies...	—	358 19	58 3	463 7	1985 0	52 7	70 5	30 9	61 14	1917 18	2050 17	
	Total for 31 Societies... (omitting Calne)	—	307 15	58 3	412 3	1998 11	43 8	60 15	25 9	50 7	1917 18	2041 5	

of this system, which gives the advantage of a sound financial position to the older members, whose contributions and good management have built up the insurance fund, is seen in the case of the Kemerton and Overbury Club, the history of which will be found in this *Journal* for June, 1912, p. 209. Under this plan, while a new member of less than four years' standing pays altogether 5*s.* a year for the insurance of a store-pig, all members of more than four years' standing, which in this case means 58 out of 86 members, are now "free members," and have their successive pigs insured to their full value against death from disease or accident for a total payment of 8*d.* a year. A similar result has been obtained in the adjoining club at Bredon, in Worcestershire, the history of which is given below.

Bredon Pig Club.

This club was started thirty-four years ago, and now consists of 94 members, mostly working-men, and insures 144 pigs. On the average of the last nine years, the death-rate has been only 1·2 per cent. per annum; the amount paid on claims averaged £3 15*s.* per pig, and only 10½*d.* per annum per pig insured; the amount at credit of the insurance fund increased during the nine years from £120 to £151, or a little over £1 per pig insured. A new member pays 4*s.* 4*d.* per annum on every store-pig insured, and 8*d.* per annum towards management expenses. When he has been a member of the club for four years and has paid altogether, including entrance fee, £1 1*s.* per pig, he becomes a "free member," and his pig stands insured to its full value for a total payment of 8*d.* per annum, which goes to the management fund—a truly wonderful result of care and co-operation. (See also *Journal,* October, 1912, p. 582.)

Management of the Clubs.

The affairs of these village clubs are managed by committees elected from among the members themselves, each member having one vote in all affairs connected with the administration of the club. The committee of management usually consists of ten or twelve members, but the number varies from five to sixteen. The office-bearers generally consist of two or three trustees, a chairman, a secretary, a treasurer, and one or more markers, the duty of the latter official being to inspect and accept as insured all pigs offered for insurance. He is usually paid by the owner of the pig a small fee varying from 1*d.* to 3*d.* per pig marked, to which in a few cases the club makes an addition from its funds. It would seem to be sounder policy for the club to pay a reasonable remuneration to this important functionary, recouping itself from the entrance fees paid by the members. Perhaps an annual payment of 10*s.* *plus* 2*d.* for every visit he pays, whether to inspect a pig for marking or to see a pig that has fallen ill (to be defrayed from the club funds), would be a fair amount to pay the marker in most clubs; in any case, it would be well worth the while of a club to secure a good man for this post, and to keep him in it permanently, so long as his work gives satisfaction to the members.

Means for Reducing the Death-rate.

The valuation of pigs when they fall ill or meet with an accident is generally made by one or more members of the committee, aided by the marker, but some clubs appoint a special valuation committee.

The most important question for the consideration of a pig club is the annual death-rate among the insured pigs, and what can be done by care taken in this matter is shown by the low death-rate obtained by the Kemerton and Bredon Clubs, which, as already said, have an average death-rate of only about 1 per cent. per annum. All clubs expect their marker not to accept a pig for insurance unless it is sound and free from disease at the time of his inspection. Most of them provide that no pig will be accepted for insurance until it is 7, 8, 9, or 10 weeks old, and many clubs provide that no insurance will be paid if the pig dies in consequence of castration. Most clubs lay down that no insurance will be paid to a new member the first quarter after he joins the club, but few of them make any provision against the danger of a new pig, brought in from outside, possibly infected with disease, or being likely to suffer from its change of quarters or of diet, and it would seem to be wise in this matter to adopt the example of one club, which provides that no pig shall be accepted for insurance until it has been in the possession of its owner for fourteen days. Until a pig has been on its owner's premises for some time, the marker is not in a position to judge whether it is free from disease and likely to thrive in its new quarters, and it seems to be not uncommon for a young pig taken from a dry pig-sty, where it has been kept warm by its mother, and put by itself in a cold, draughty, perhaps damp, sty, to fall ill and die simply owing to want of ordinary care on the part of its new owner. Most clubs have a rule to the effect that the society will not be liable for any insured pig which has been wilfully neglected by its owner, but many of them seem to take little trouble to enforce this rule, and it might possibly be advantageous if the committee were required to inspect the sties, in which insured pigs are kept, from time to time, and satisfy themselves that they are in a proper sanitary condition.

One of the chief reasons for the high death-rate shown by a number of the clubs appears to be the custom, already referred to, which has sprung up, of selling a pig suspected of disease for what it will fetch, and paying the difference between that and its full value out of the club funds. In some parts of the country it appears to be usual, when a fat pig refuses his food—especially if the weather is hot—to jump to the conclusion that it is probably suffering from "the purples," or some other form of disease, and to send for the butcher and make over the pig to him for whatever price he is willing to give in the circumstances. The butcher probably does not consider it necessary to inform his customers that the pig was suspected to be ill, but he runs some risk, and is not likely to give for it anything approaching the price that it would have fetched the day before. If the pig was going to die, this procedure saves the club from a certain amount of loss; but to judge from the experience of other animals, it does not at all follow that when a pig is "off his feed" he is necessarily seriously ill, and it seems probable that in many of these cases a little care and patience would have restored the pig to good health, and, if so, the hasty condemnation of the pig involves the club in unnecessary loss. It is generally in clubs in which this custom has been adopted that the death-rate is excessively high; on the other hand, the best-managed clubs with a low death-rate never sell a pig suspected to be ill. They do their best to cure it, and, if it dies, the carcass is buried, and the club stands the loss. It would seem to be wise to follow their example, and to make a rule that in no case shall the carcass of an insured pig suspected of disease be sold, and that unless the pig is slaughtered by order of some authority, or its destruction is approved by the committee on grounds of humanity, every endeavour shall be made to restore it to health, and that, if it dies from disease, its carcass shall be buried. This course would not only protect the club from unnecessary loss, but would save its members and officers from some prickings of conscience and from the risk of being prosecuted for abetting the sale of pork unfit for human food. Care should be taken by the members and officers of the society to avoid any contravention of the provisions of the Swine Fever Order of 1908, and other Orders of the Board relating to contagious diseases.

According to the combined experience of these 31 village clubs, it would seem reasonable for the small pig owners of any parish in England or Wales, which is not exceptionally unhealthy for pigs, to expect that if they establish a pig insurance club on similar lines and pay due attention to its administration and to the care of their pigs, their average death-rate will not exceed 4 per cent. per annum, and may be reduced to a much lower rate, and that if they charge an insurance contribution per annum of 2*s.* per store-pig and 8*s.* per sow or boar, with a contribution towards the management fund of 1*s.* per annum per pig insured, they will be able to pay on each pig that dies from disease or accident four-fifths of its full value, and to build up a reserve fund which in a few years will enable them to reduce the amount of contribution payable by members of over five years' standing by one-half, so long as the balance at the credit of the insurance fund exceeds the equivalent of 10*s.* per pig insured; and thereafter to insure their store-pigs by a total payment of 2*s.* per pig per annum.

Average Death-rate among Pigs.

The Agricultural Statistics show that in June, 1911, there were in Great Britain, on holdings of above one acre in area, over 2,800,000 pigs, of which nearly 400,000 were sows kept for breeding purposes. Each sow produces on the average about 11 pigs in the year, so that the number born in the year was probably nearly 4,400,000. In the Report on the Agricultural Output of Great Britain, it was estimated that during the year 1908–9 4,400,000 pigs were sold off the farms of the country, of the total value of over £14,000,000, which gives the average value per pig sold as about £3 5*s.* The death-rate among pigs for that year was estimated at 7 per cent. on the stock enumerated in June, but this includes deaths among young pigs born during the twelve months.

Pig Insurance with Insurance Companies.

Live-stock insurance companies do not encourage the insurance of pigs, and the number of pigs insured with them is infinitesimal. They generally charge a premium of 5 per cent. on the maximum amount payable on the death of a store-pig, and 7½ per cent. in the case of a breeding-sow or boar, and this premium does not cover the risk of death from swine fever, fire, or lightning. Usually they refuse to insure pigs under six months old, and one company at least declines to insure pigs unless horses or cattle are also insured. It seems safe to say that no insurance company would undertake, for less than 8*s.* per annum, the risks successfully undertaken by these village clubs at a total cost to their members of less than 3*s.* per annum. It is probable that of the six to seven millions of pigs that are alive in Great Britain in the course of a year not much more than 1 per cent. are insured, and that that insurance is almost entirely effected by means of little village clubs. Possibly the death-rate among pigs kept together in considerable numbers may be larger than in the case of pigs kept separate in solitary sties, and the costs of management of a large association might be higher than in a small club, but there seems reason to believe that if the farmers would follow the example set them by the working-men, and form mutual pig insurance societies, they would be able to insure each other against loss of their pigs by disease or accident on payment of 4s. per pig per annum, which, after a reserve fund has been built up, might be reduced to 3*s.* per pig per annum, or possibly less.

Organisation of the Sale of Live Stock in Austria.

Attempts have recently been made in Austria to organise the sale of live stock on a co-operative basis. In order to eliminate the large number of "middlemen" who intervene between the farmer and the consumer, the "General Federation of the Agricultural Co-operative Societies of Austria" opened in 1907, at the central market of Vienna, its own stockyards for the sale of animals for slaughter. All live stock sent to these stockyards by farmers is sold by the Federation at the best possible prices. The Federation works through reliable agents residing in the chief animal-breeding districts, who collect the live stock which the individual breeders have for sale, and forward it to Vienna. The animals are received at Vienna by other agents of the Federation, and are kept in the yards until a favourable opportunity occurs for selling them. The purchase money is forwarded to the farmer, deductions being made for expenses only, no commission being charged.

The value of the scheme was apparent from the fact that, in those districts in which it was put into operation, dealers in live stock immediately began to offer higher prices for animals. The value of the live stock sold in the yards of the Federation rose from £125,000 in 1908 to £550,000 in 1911. In all, 133,650 animals were sold in this way in 1911, viz.:—2,830 oxen, 1,049 bulls, 829 heifers, 247 calves, 335 sheep, and 128,360 pigs. In view of the success of the scheme as regards animals for slaughter, the Federation proposes to undertake in the future the sale of breeding stock and dairy cows.

The movement has also received the support of the Austrian Ministry of Agriculture, the latter having opened an office, the work of which appears to be mainly of a propagandist type; it gives advice and lectures to farmers, sends out agents, and distributes publications.

The success of the co-operative stockyards at Vienna has led to the opening of ten similar stockyards in various parts of the country, and to the formation of 130 local co-operative societies for collecting and forwarding live stock to these stockyards.

A great difficulty in the way of these societies is the fact that they have not sufficient means to pay their members for the animals supplied, or to make them advances. Consequently, when a farmer is urgently in need of money he prefers to sell his animals to a dealer, who pays for them on the spot, rather than to the co-operative society, which can only pay after it has itself received the purchase money. (*Bull. Bur. Econ. and Soc. Int.*, July, 1912.)

Proposed Legislation in Holland to enable Agricultural Labourers to Acquire or Rent Land.

As a result of the report of a Commission appointed in Holland to inquire into the economic condition of agricultural labourers, a Bill has been brought forward to "enable agricultural labourers to become proprietors of land with dwelling-houses, or to rent land."

According to this Bill, the land, the value of which must not exceed about £200, is to be purchased through the medium of approved associations to be formed in every canton, and having for their sole aim the promotion of the purchase of land by agricultural labourers. The money for purchasing the land will be lent by the State to the communes of the cantons, and by them to the associations, in each case at the rate of 3½ per cent. per annum. Facilities for purchase are only given to agricultural labourers between the ages of twenty-five and thirty, who can pay at least one-tenth of the purchase value; the remaining nine-tenths are lent to the purchaser by the associations (or communes).

Repayment of the borrowed money is made as follows:—For the first two years interest must be paid at the rate of 3½ per cent.; from the third year onwards repayment must be made in thirty annual instalments at 5½ per cent. The purchaser, however, may, if he desires, pay less, for the Bill authorises him to burden the property he has bought to the extent of one-fourth of the sum borrowed, with an annual charge, redeemable at any time, or only after the complete extinction of the remainder of the debt.

As a guarantee for the sum borrowed, the purchaser gives a mortgage on the property bought, but the deeds, &c., are free from stamp and registration duties. The purchaser is not allowed to let the land while the instalments are unpaid, or to dispose of it to anybody else during his lifetime, but his testamentary liberty is in no way restricted.

The Bill also provides that small plots of land may be let to agricultural labourers who have no land. The rent must not exceed about £2 10*s.* per annum. The land must be suitable for cultivation and well situated. The letting is carried out by the associations mentioned above, or by the communes. (*Bull. Bur. Econ. and Soc. Int.*, July, 1912.)

Reconstitution of the Agricultural Organisation Society.

The Agricultural Organisation Society has been reconstituted as a company limited by guarantee under the Companies (Consolidation) Act, 1908, in order that it may be in a position to act as the agent for the administration of the grant from the Development Fund which the Development Commissioners are prepared to recommend the Treasury to make with the object of extending the organisation of co-operative methods in agriculture.

It is provided by the Articles of Association that the Governors of the Society shall be appointed in the first instance by the Board of Agriculture and Fisheries and the Development Commissioners jointly, and that the persons so appointed shall hold office until April, 1914. The first Governing Body has been duly appointed, and consists of the following:—Mr. R. A. Yerburgh, President; the Earl of Shaftesbury, K.P., K.C.V.O., Chairman; Mr. F. D. Acland, M.P.; Mr. Charles Bathurst, M.P.; Mr. S. Bostock; Mr. W. Fitzherbert Brockholes; Mr. Philip Burtt; Mr. E. J. Cheney; Mr. H. C. Fairfax Cholmeley; Mr. J. S. Corbett; Mr. Rupert Ellis, Mr. H. Jones Davies; Mr. Cyprian Knollys; Mr. Clement Smith; the Hon. Edward Strutt; Colonel R. Williams, M.P.; Mrs. Roland Wilkins; Sir James Wilson, K.C.S.I.; Lord Strachie and Mr. Abel H. Smith (nominated by the County Councils Association); Mr. Duncan McInnes; and Mr. A. Whitehead (nominated by the Co-operative Union); and Mr. G. L. Pain (nominated by the County Land Agents Association).

The amount of the grant to be made from the Development Fund to the Society is still under consideration, but in the meantime arrangements are being made for an interim grant to enable it to continue its current work up to March 31st, 1913.

After April, 1914, the Governing Body of the Society will be constituted as follows:—

(*a*) Eighteen Governors to be elected by the Members of the Society;

(*b*) Twelve Governors to be appointed by the Board of Agriculture and Fisheries;

(*c*) Two Governors to be appointed by the County Councils Association;

(*d*) Two Governors to be appointed by the Co-operative Union; and

(*e*) Two Governors to be co-opted by the Governors.

OFFICIAL NOTICES AND CIRCULARS.

Foot-and-Mouth Disease.

No outbreak of Foot-and-Mouth Disease has been confirmed in Great Britain since October 8th. Since that date all restrictions which had been imposed by the Board on account of the appearance of the disease have been entirely withdrawn from the East Sussex, Flintshire, and Hampshire areas, and the restrictions have been modified considerably in the Northumberland and Durham, and the Northumberland (Kirkheaton District) areas. Restrictions imposed by the Board on the movement of animals in Great Britain on account of Foot-and-Mouth Disease in this country are now in force only as regards two small areas—one in the city of

Newcastle-on-Tyne and one in North Durham—and movement from certain farms in the Kirkheaton District of Northumberland is controlled.

Loans for the Equipment and Adaptation of Small Holdings.

The Board of Agriculture and Fisheries have issued the following circular letter, dated October 10th, 1912, to County Councils and Councils of County Boroughs in England and Wales:—

SIR,—I am directed by the Board of Agriculture and Fisheries to advert to the Instructions enclosed with their Circular Letter of May 22nd, 1911 (A. 198/C), and to say that they are informed by the Local Government Board that delay is frequently caused in dealing with applications from County Councils for consent to loans for the equipment and adaptation of small holdings owing to the failure of certain Councils to comply with the Instructions referred to. This occurs more especially in cases of proposed works of adaptation to buildings as to which the Local Government Board experience considerable difficulty in determining the period to be allowed for the repayment of the loan in the absence of a detailed estimate showing separately the cost of (*a*) new work; (*b*) structural repairs; and (*c*) decorative work, such as papering, painting, plastering, &c.

I am accordingly to ask that any proposal for the adaptation of buildings on small holdings submitted to this Board may be accompanied by a detailed estimate of cost in the form indicated above, briefly describing the nature of the proposed works under each head, and, further, that in all cases of proposals for the equipment and adaptation of small holdings, the Instructions to which attention has been drawn may be strictly complied with.

In fixing the rents to be charged for small holdings provided by the Council regard should be paid to the fact that a shorter term of years will be allowed for decorative and other repairs of a temporary character than for structural repairs or new work.

I am to add that in cases where Councils submit to the Board proposals for the expenditure of additional sums on adaptation and equipment over and above those which are provided for in any scheme already confirmed by the Board, a statement should be supplied showing the sums which have already been borrowed under the scheme, and the term of years within which each loan is repayable.

I am, &c.,
T. H. ELLIOTT,
Secretary.

MISCELLANEOUS NOTES.

Agricultural Estates belonging to the Crown.

The sixth report of the President of the Board of Agriculture and Fisheries as a Commissioner of Woods is included in the recently issued ninetieth report of the Commissioners of His Majesty's Woods, Forests and Land Revenues (H.C. 187, 1912, price 1*s*.).

The principal agricultural estates belonging to the Crown and under the charge of the President of the Board of Agriculture and Fisheries as a Commissioner of Woods, comprised at

March 31st, 1912, about 67,288 acres. This is an increase in area as compared with the area under the charge of the President at March 31st, 1911, of about 3,808 acres. Two of the estates purchased in 1911–12, comprising an area of 3,589 acres, were not let at March 31st, 1912. The remaining 63,700 acres are divided as follows, viz.:—7,524 acres let for small holdings and allotments; 56 farms containing between 50 and 250 acres; 62 farms containing between 250 and 500 acres; 22 farms containing between 500 and 750 acres; one farm of an area between 750 and 1,000 acres; 6 farms containing upwards of 1,000 acres, consisting largely of downland; about 756 acres of grassland, the grazing of which is let annually in lots by auction; and about 2,550 acres of woodland.

The land let for small holdings and allotments up to March 31st, 1911, amounted to 7,124 acres, and the land so let to March 31st last was 7,524 acres, being an increase of about 400 acres during the past year, and a total increase of 6,531 acres in the last six years. Since the policy of encouraging the creation of small holdings and allotments on Crown lands was inaugurated six years ago, there have been erected on the agricultural lands turned into small holdings and allotments 67 new cottages and 52 new sets of farm buildings; 28 cottages have been substantially altered and improved, and the homesteads and buildings which were on the farms divided into small holdings have been remodelled to fit them for the use of 30 small holders. On the 400 acres of land let for small holdings during the year to March 31st last three new cottages have been, or are being, erected, two are being substantially improved, and the existing homesteads and buildings on the lands subdivided are being remodelled to fit them for the use of seven small holders.

The gross receipts during the year ended March 31st last from these estates were £65,548, as compared with average gross receipts per annum for the previous three years of £63,241. The average gross receipt for the three years to March 31st, 1907 (the year in which the management of the agricultural estates was taken over by the President of the Board of Agriculture and Fisheries), was £53,991, so that during the past five years the gross receipts have increased, owing to various causes, by £11,557. After deducting the expenditure, the net income received during the past year amounted to £39,154.

With regard to the management of the woods at Delamere, County Chester, comprising 2,000 acres, a considerable expenditure was incurred in improving the drainage, in fencing, and in forming a new nursery. An area of about 39 acres has been replanted, making a total of 144 acres replanted since 1908.

IMPORTATION REGULATIONS.

Importation of Plants, Seeds, Manures, &c., into Uruguay.—Regulations were issued on March 13th last giving effect to a law of October 21st, 1911, on the subject of the protection of the agricultural industry of Uruguay. Special regulations are laid down respecting the importation of plants, seeds, manures, and other articles likely to introduce certain pests. These regulations provide, *inter alia,* for the rejection of lucerne and other forage seeds containing over 20 grams of dodder per kilogram.

Products or machines destined for the destruction of agricultural pests may be admitted free of customs duty, subject to the authorisation in each case of the Comision Central de Defensa Agricola.

A translation of the relevant parts of the Regulations may be seen at the office of the Board, 4 Whitehall Place, London, S.W.

Admission of Hay, Straw, and Manure into France.—The decree of the French Ministry of Agriculture of February 20th, 1911, prohibiting the importation of hay, straw, and manure into France (see *Journal,* April, 1911, p. 75) has been abrogated by a Decree of the Ministry of Agriculture dated July 29th, 1912. (*Board of Trade Journal,* September 26th, 1912.)

Importation of Potatoes into Canada.—An Order-in-Council was passed on September 19th, 1912, amending the regulations issued under the "Destructive Insect and Pest Act," with the effect that the importation into Canada of potatoes from Europe is now prohibited. (*Board of Trade Journal,* October 24th, 1912.)

Importation of Animals into Sweden.—A notice of September 3rd, 1912, declares the whole of Great Britain and Ireland, with the exception of the Channel Islands, infected with foot-and-mouth disease. A note as to the restrictions which result from this declaration will be found in this *Journal* for November, 1911, p. 690.

Importation of Live Stock into the Falkland Islands.—The Board have been informed by the Colonial Office that, owing to the outbreak of foot-and-mouth disease in this country, the importation of live stock into the Falkland Islands from the United Kingdom has been prohibited.

The general regulations respecting the importation of live stock into the Falkland Islands were established by a Proclamation (No. 182) of November 14th, 1911. These provide that any person intending to import cattle, horses, sheep, pigs, goats, and dogs must give a month's notice in writing to an inspector, stating the number of animals, description, from whence expected, where purchased, and probable date of arrival in the Colony. Every such animal imported from a British port must be accompanied by a health certificate signed by a qualified veterinary surgeon of the district in which the animal was purchased. Every imported animal will be examined by an inspector, who has the power to prohibit the landing of any such animal which would be a source of danger to other animals in the Colony, to order it to be destroyed, or to be placed in quarantine.

Importation of Animals into the East Africa Protectorate.—A Proclamation of August 28th, 1912, prohibits the importation of cattle into the East Africa Protectorate from the United Kingdom unless the cattle have undergone quarantine for a period of one month in a Government Veterinary Laboratory in the United Kingdom, and on leaving such laboratory have been certified free from disease, and have been entrained direct from the quarantine station to the docks for shipment. On the importation of the cattle into the Protectorate, a certificate of the Chief Veterinary Officer is required to be produced certifying that the above conditions have been complied with.

A further proclamation of the same date prohibits the importation of sheep and pigs from the United Kingdom. (*Board of Trade Journal*, October 3rd, 1912.)

Importation of Live Stock into New Zealand.—The Board of Agriculture and Fisheries have been officially informed that the Government of the Dominion of New Zealand have now sanctioned the shipment of cattle, sheep, and pigs from Great Britain to New Zealand on the following conditions:—(*a*) The shipper must obtain, in respect of each consignment, a special permit from the High Commissioner for New Zealand, 13 Victoria Street, London, S.W.; (*b*) the animals must be examined at the place of origin by the New Zealand Veterinary Inspector in this country; (*c*) no shipments may be made from Liverpool; (*d*) no cattle, sheep or pigs may be exported from the counties of Durham or Northumberland, or from a place less than fifteen miles from premises on which there has been an outbreak of foot-and-mouth disease within the two months preceding the date of shipment; (*e*) no fodder may accompany stock (including horses) unless it is derived from Scotland or from a district in England where no cases of foot-and-mouth disease have occurred. Shippers should communicate, in the first instance, and at as early a date as possible before shipment, with Alexander Crabb, Esq., Veterinary Inspector to the New Zealand Government, Terminus Chambers, 6 Holborn Viaduct, London, E.C.

Notes on Agriculture Abroad.

Measures for Combating American Gooseberry Mildew in Holland.—A law of September 23rd, 1912, contains provisions for preventing the introduction of, and for combating, American Gooseberry Mildew.

The importation and transit of gooseberry bushes, black currant bushes, red and white currant bushes, raspberry bushes, parts of such bushes, and materials which have been used for packing such bushes is prohibited, except where these are introduced for scientific purposes.

The law compels the occupier of any premises on which an outbreak of American gooseberry mildew occurs to give immediate notice of the outbreak. Compulsory measures will be prescribed for combating the disease, which may include picking and destruction of diseased fruit, cutting and destruction of diseased shoots, uprooting and destruction of diseased bushes, and digging up the soil. The removal of bushes from affected premises will be prohibited.

The Yield of the State Forests of Saxony in 1910.—The area of the State forests of Saxony in 1910 was 426,000 acres. The amount of utilisable timber obtained from fellings of wood over 3 in. in diameter was 26,000,000 cubic feet. The total receipts were £775,000, viz.: £769,000 from timber, and £6,000 from minor forest produce. The total expenses were £321,000, viz.: wages of woodcutters, £114,000; forest improvements, £22,000; working expenses, £60,000; and management and protection, £125,000. Thus the net returns were £454,000, or £1 1*s.* 3*d.* per acre, or £1 9*s.* 8*d.* per 100 cubic feet of wood over 3 in. in diameter. The forest capital is £20,755,000, so that the return on the capital in 1910 was 2·19 per cent.

The principal items under forest improvements were: sowing of 287 acres at an average cost of £1 16*s.* per acre, and planting of

6,381 acres at an average cost of £2 2s. per acre. The cultural expenses of conifers are of interest; the highest cost per acre was £4 3s. (3s. per 100 trees), and the lowest 18s. 7d. (8d. per 100 trees). (*Bull. Bur. Agric. Int. and Pl. Dis.*, August, 1912.)

Notes on the Weather in October.

The weather during the *first* week (September 29th to October 5th) was unsettled at first, but fair later. Warmth was everywhere "deficient." Rainfall was less than the normal in most of the western districts, but in excess elsewhere. Bright sunshine was generally in excess of the average.

The conditions were generally dry and bright in the *second* week. Morning mist or fog was, however, rather prevalent over England. Temperature was above the average in Scotland and the northern districts of England, and below it elsewhere; in England S.E. the deficit was nearly 4°. Over a large portion of England there was no rain, and in Scotland the fall was mostly slight. Bright sunshine exceeded the average in all districts, the excess being very marked in England.

Rain was experienced almost daily in the *third* week over a large area in the north and north-west of Great Britain, but in the south and east of the country rain was less frequent, and several days were fair to bright. Over the whole week rainfall was less than the average in the greater part of England and also in Scotland E., but it exceeded it in Scotland N. and W., and England N.W. Warmth was "unusual" in England N.E., N.W., and the Midland Counties, and "moderate" in England E., S.E., and S.W., and Scotland N., E., and W. Bright sunshine was below the normal generally, but above it in England E. and S.E.

In the *fourth* week the general condition was unsettled, but some fair days were experienced in central and eastern England. Temperature was below the average, the deficit being nearly 5° in Scotland W. and 3° or more in most other districts. Rainfall was greatly in excess of the normal generally, but was less in Scotland N. Bright sunshine was everywhere less than the average.

The following note on this year's potato crop in Lincolnshire and Cambridgeshire has been furnished by Mr. H. Amos, of Wisbech:—

Potato Harvest in Lincolnshire and Cambridgeshire.

The variety most generally planted in Lincolnshire and Cambridgeshire in the past season was King Edward. Next came the Up-to-Date types, including Factor, Dalhousie, Table Talk, &c., and then Evergood. Very few Royal Kidney, Northern Star, or President were planted.

Not many first earlies are grown in these counties, but of these Duke of York, Early Eclipse, Early Epicure, and Midlothian Early, and for second earlies, British Queen, were the most popular.

The time of planting was quite favourable, and the seed went in well, though some of it was, perhaps, a little late. Directly growth began, it became apparent that one or two varieties missed a good deal, Duke of York, Early Eclipse, and British Queen being the worst. This was due to the seed being old seed, but other kinds looked fairly promising and showed indications of a satisfactory crop. About the first week in July the first earlies began to be dug, prices being very fair, but the crops light. Then came the "blight," all varieties showing the disease, more especially those from old seed, and in a day and a night the haulm of many crops changed from a healthy green to a dead-brown colour. Farmers did their utmost to save their crops, and spraying was resorted to, but with unsatisfactory results.

Up to August 20th it was noticeable in all districts that where "Scotch" seed was planted the haulm remained green, and the tubers continued growing, while where old seed had been planted growth had ceased with the exception of three varieties, viz., Northern Star, President, and Evergood. These kinds were green and growing well, but, unfortunately, of the two former very few in comparison were planted this season, as they are not very saleable, while the latter variety, which has always been a prolific cropper, and grows a good shape, is not one of the best cookers.

By this time it was recognised that the crop would be very light and diseased, but worse was to come. Between August 24th and September 3rd the heavy rains nearly destroyed the potato crop, many hundreds of acres being completely under water for days. In many cases the crop would not pay for digging. Taking the two counties together the best croppers have been Evergood, Northern Star, and President, which probably average 7 tons; the King Edward and Up-to-Date types may be put at 3 tons; British Queen and second earlies at 5 tons; and Duke of York and first earlies at 3 tons.

Produce of Hops.

The Board of Agriculture and Fisheries have issued the following preliminary statement, dated October 17th, showing the estimated total production of hops in the years 1912 and 1911, with the acreage and estimated average yield per statute acre in each county of England in which hops were grown.

COUNTIES, &c.		Estimated Total Produce.		Acreage Returned on 4th June.		Estimated Average Yield per acre.	
		1912.	1911.	1912.	1911.	1912.	1911.
		Cwt.	Cwt.	Acres.	Acres.	Cwt.	Cwt.
KENT	East	74,415	61,606	5,993	5,718	12·42	10·77
	Mid	85,718	79,101	7,330	6,966	11·69	11·36
	Weald... ...	100,277	86,032	8,077	7,507	12·42	11·46
	Total, Kent	260,410	226,739	21,400	20,191	12·17	11·23
HANTS		18,473	14,627	1,516	1,444	12·19	10·13
HEREFORD		29,450	29,251	5,236	5,034	5·62	5·81
SURREY		5.264	4,269	513	500	10·26	8·54
SUSSEX...		34,098	29,847	2,845	2,698	11·99	11·06
WORCESTER		24,880	22,630	3,186	3,061	7·81	7·39
OTHER COUNTIES* ...		863	655	133	128	6·49	5·12
TOTAL		373,438	328,023	34,829	33,056	10·72	9·92

* Gloucester and Salop.

NOTE.—The estimated average yield per acre, nearly 10¾ cwt., is four-fifths of a cwt. above that of 1911, and 2 cwt. above the ten-years' mean. The acreage being also 1,773 acres above that of 1911, the total production is thus 45,000 cwt. more, and it is also nearly 9,000 cwt. more than the average of the last ten years.

Produce of Corn, Pulse and Hay Crops.

The following preliminary statement shows the estimated total produce and yield per acre of the corn, pulse, and hay crops in England and Wales in the year 1912, with comparisons for 1911, and the average yield per acre of the ten years 1902–1911:—

Crops.		Estimated Total Produce.		Acreage.		Average Estimated Yield per acre.		Average of the Ten Years 1902–1911.
		1912.	1911.	1912.	1911.	1912.	1911.	
		Qrs.	Qrs.	Acres.	Acres.	Bshls.	Bshls.	Bushels.
WHEAT	England . .	6,573,983	7,359,142	1,821,931	1,804,045	28·87	32·63	31·83
	Wales . . .	136,200	135,430	41,412	38,487	26·31	28·15	27·17
	England and Wales	6,710,183	7,494,572	1,863,343	1,842,532	28·81	32·54	31·71
BARLEY	England . .	5,204,817	5,256,546	1,365,038	1,337,431	30·50	31·44	33·43
	Wales . . .	344,049	330,678	91,484	86,800	30·09	30·48	31·24
	England and Wales	5,548,866	5,587,224	1,456,522	1,424,231	30·48	31·38	33·30
OATS .	England . .	8,326,073	8,981,803	1,865,569	1,841,136	35·70	39·03	42·27
	Wales . . .	853,141	858,792	206,910	206,037	32·99	33·35	35·27
	England and Wales	9,179,214	9,840,595	2,072,479	2,047,173	35·43	38·46	41·59
BEANS .	England . .	925,457	917,591	270,148	294,059	27·41	24·96	30·18
	Wales . . .	3,479	3,456	1,121	1,134	24·83	24·38	27·12
	England and Wales	928,936	921,047	271,269	295,193	27·40	24·96	30·17
PEAS . .	England . .	486,120	458,976	172,707	139,150	22·52	26·39	27·31
	Wales . . .	1,772	1,641	623	561	22·75	23·40	22·18
	England and Wales	487,892	460,617	173,330	139,711	22·52	26·38	27·28
		Tons.	Tons.			Cwts.	Cwts.	Cwts.
HAY from Clover, Sainfoin, &c.	England . .	1,804,871	1,774,464	1,378,938	1,465,383	26·18	24·22	30·12
	Wales . . .	226,157	185,658	175,924	172,049	25·71	21·58	25·20
	England and Wales	2,031,028	1,960,122	1,554,862	1,637,432	26·12	23·94	29·61
HAY from Permanent Grass	England . .	5,530,548	3,898,205	4,394,906	4,283,629	25·17	18·20	24·32
	Wales . . .	563,868	444,891	546,628	547,194	20·63	16·26	19·86
	England and Wales	6,094,416	4,343,096	4,941,534	4,830,823	24·67	17·98	23·83

NOTE.—The total yield of wheat in England and Wales in 1912 amounts to 6,710,183 qr., which is more than three-fourths of a million quarters less than last year. The yield per acre, 28·81 bush., is nearly 4 bush. less than in 1911, and almost 3 bush. less than the decennial average. The yield per acre of barley was nearly 1 bush. below that of 1911, and, like wheat, nearly 3 bush. below the average, but in consequence of the increased acreage, the total production is very little below that of last year. Oats are more deficient, being fully 6 bush. per acre below the average, and 3 bush. below last year; while the total production falls short of 1911 by some two-thirds of a million quarters. Beans are 2¾ bush. below the average, but better than last year's poor crop. Peas are 4¾ bush. below average, but, in consequence of a considerably increased acreage, the total production is a little above that of 1911. The hay crop is much larger in bulk than last year; that from clovers and rotation grasses is nevertheless 3½ cwt. below the average. Meadow hay is the only one of the seven crops now reported on which shows an over-average yield, although the excess is not more than five-sixths of a cwt. The total production of hay of all kinds amounts to 8,125,444 tons, which is nearly two million tons more than was produced in the droughty season of 1911.

Agricultural Conditions on November 1st.

The Crop Reporters of the Board, in reporting on the results of the corn harvest, all refer to the poor quality of the grain. In consequence of the wet and cold season the grain is small, badly matured, and often damp and sprouted. In some parts of the country, however, wheat and barley were harvested in dry weather, and in those cases condition and quality are fair, but they are not the majority. Barley is perhaps, in some counties, not quite so inferior in quality as wheat, but most samples are discoloured, and the quantity suitable for malting will be much less than usual. Oats seem decidedly the worst of the three cereals.

The bulk of the potato crop has been lifted; as already reported, there is much disease all over the country, although some areas are fairly free. In some districts a very considerable proportion is so diseased as to be unmarketable; and in many places, the proportion of sound tubers has proved to be larger than was feared. The potatoes are practically everywhere of small size.

Mangold lifting was very generally in progress, but little had been done with pulling turnips and swedes, which had made growth during October, and were still growing at the date of the reports. The roots are everywhere small, but are generally reported as sound and of fair quality.

Autumn cultivation, owing to the lateness of the harvest, was generally backward; and the weather, in spite of having been mostly fine, was not everywhere very suitable, the land in some cases being too hard to work, while some rather heavy rains at the end of the month caused interruption. Operations were even more behindhand in the north. Some fair breadths of wheat had been sown, especially in the south and east, under favourable conditions; while some winter oats had also been got in; still, large areas remained unsown. In the few cases where the wheat was up, it was looking well.

Seeds are very thick, healthy and vigorous almost everywhere. In many districts, sheep have been turned on to the young seeds for a fortnight or so; in some places in the south the clover is in bloom, and a few fields have even been cut.

As a rule, live stock have done fairly well during October with exceptions in some districts. The prospects for winter keep are very variable; roots are mostly expected to be short; this is balanced in many districts by an abundance of hay, which is, however, of poor quality. But where the hay is not abundant, fears are entertained of a scarcity of fodder during the winter.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for October, 1912, issued by the International Institute of Agriculture, shows the production of the cereal crops this year from information received up to October 15th. The countries for which it is possible to give an approximate estimate of the production are as follows:—In *Europe:* Prussia, Belgium, Bulgaria, Denmark, Spain, France, England and Wales, Ireland, Kingdom of Hungary, Italy, Luxemburg, Norway, Netherlands, Roumania, Russia-in-Europe (63 governments), Switzerland; in *America:* Canada, United States; in *Asia:* India, Japan, Russia in Asia (10 governments); in *Africa:* Algeria, Egypt, Tunis.

Wheat.—The total production for all the countries included this month is estimated at 407,097,000 qr., as compared with 379,613,000 qr. in the same countries in 1911, or an increase of 7·2 per cent. The production in the United States is now estimated at 90,025,000 qr., which shows an increase of 3,798,000 qr. on the previous figure. The total area under production in all countries is less than last year by 2·9 per cent.

Rye.—The estimated production of rye in the above countries (but excluding England and Wales, India, Japan, Egypt, and Tunis) amounts to 185,027,000 qr., which shows an excess of 17·8 per cent. over last year, when the estimate was 157,038,000 qr. The area planted, however, is 0·1 per cent. less than in 1911.

Barley.—The revised estimate for the United States places the production at 26,946,000 qr., or 1,874,000 qr. more than the previous estimate. The total production in the above countries (excluding India) is estimated to be 153,508,000 qr., against 145,958,000 qr. in 1911, or an increase of 5·2 per cent. The area shows a reduction on 1911 of 0·8 per cent.

Oats.—The total production in all the countries named above (excluding Ireland, India, and Egypt) is estimated at 418,848,000 qr., as compared with 346,988,000 qr. last year, the excess amounting to 20·7 per cent. The production in the United States is now estimated to be 145,310,000 qr., this being 13,040,000 qr. more than the previous figure. The area under production in all countries is 1·5 per cent. below that of last year.

Maize.—The revised estimate for the United States shows an increase of 2,449,000 qr., the production being now placed at 351,765,000 qr. The total production in the countries specified (excluding Prussia, Belgium, Denmark, France, England and Wales, Ireland, Luxemburg, Norway, Netherlands, and India) is greater than that of last year by 16·4 per cent., the estimate being 422,129,000 qr., against 362,678,000 qr. in 1911. The area planted also exceeds that of 1911 by 1·9 per cent.

The following supplementary notes are given:—

Austria.—The weather during September was dull and rainy in all parts, and it was impossible to begin the oat harvest until the end of the month. A great quantity still remains to be carted in the mountainous districts, and sprouting has commenced, or else the grain is rotting. The maize harvest is ended in some parts, and on October 1st the condition of the crops pointed to a production rather above the average.

France.—The ripening of the maize is going on slowly, but the harvest is considered to be good.

Roumania.—Abundant rains during September, as well as the low temperature, have retarded the ripening of the maize.

Sweden.—The estimated production of wheat is 843,000 qr., against 1,029,000 qr. in 1911, of rye 2,619,000 qr., against 2,879,000 qr., of barley, 1,755,000 qr., against 1,763,000 qr., and of oats, 8,700,000 qr., against 7,789,000 qr.

Canada.—The weather in most parts was wet during September, and on October 1st large areas of grain were still uncut or exposed to the wet in stook. Much damage has been caused by sprouting in the north-west, and second growth has, in many cases, caused uneven ripening and lowering of the grade.

Egypt.—Although a little late, the maize harvest is generally good.

Sugar Beet.—The total production in Prussia, Belgium, Bulgaria, Denmark, Spain, Italy, Roumania, and Sweden is estimated at 19,333,000 tons, against 11,477,000 tons in 1911, or an increase of 68 per cent. The estimated production in Prussia is placed at 12,880,000 tons, an increase of 118 per cent. on that of last year, in Italy at 1,476,000 tons, an increase of 4 per cent., and in Sweden at 974,000 tons, an increase of 21 per cent. Revised figures are given for Belgium and Denmark. In Belgium the production is now estimated at 1,791,000 tons, and in Denmark at 791,000 tons. A good yield is expected in Austria, while in France it is estimated that the sugar content will be about the same as in 1911.

Hungary.—According to the official report of October 7th, the production of potatoes this year is estimated to be 5,051,000 tons, as compared with 4,366,000 tons last year. The estimated yield of maize is given as 22,266,000 qr., against 16,028,000 qr. in 1911.

Hops.—H.M. Consul at Portland, U.S.A., reports that the crop in the district of Oregon has exceeded all estimates, but that owing to rains during the picking season, the quality is reported to be variable. Estimates vary, but it is generally agreed that the yield in Oregon is not less than 189,955 cwt., and in Washington 57,812 cwt., of all grades. H.M. Consul at Warsaw reports that at the recent annual hop fair the total supplies, including a proportion left over from last year, amounted to 624,744 lb., as against 306,000 lb. in 1911. The total sales reached 480,600 lb., as against 187,200 lb. in the previous year. The balance unsold was mostly of inferior quality.

Canada.—A report issued by the Census and Statistics Office at Ottawa on October 18th states that of spring wheat the estimated production in 1912 is 188,816,600 bush., as compared with 189,904,500 bush. last year. Of fall wheat the production is 16,868,700 bush., as compared with 26,014,000 bush. last year, the total estimated wheat production being therefore 205,685,300 bush., as compared with 215,918,500 bush. in 1911, a decrease of 5 per cent., the yield per acre being 21·08 bush., as against 20·77 bush. Oats show a total production of 381,502,000 bush., compared with 348,585,600 bush. last year, the yield per acre being 41·39 bush., compared with 37·75. Barley is estimated to yield a total of 43,895,100 bush., compared with 40,631,000 bush. last year, the yield per acre being 31·00 bush., against 28·94. The total production of rye is 3,086,000 bush., against 2,668,800 bush. in 1911, the yields per acre being respectively 20·75 and 17·41 bush. The estimated production of peas is 4,202,400 bush., of beans 1,106,800 bush., of buckwheat 10,924,100 bush., of flax-seed 21,143,400 bush., of mixed grains 17,940,900 bush., and of maize for husking 14,218,400 bush.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on November 1st, 1912, certain disease of animals existed in the countries specified:—

Austria (for the period October 23rd—30th).
Anthrax, Blackleg, Foot-and-Mouth Disease (total of 933 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period September 16th—30th).
Anthrax, Blackleg, Foot-and-Mouth Disease (6 "foyers" in 4 "communes"), Rabies.

Bulgaria (for the period September 14th—21st).
Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Swine Fever.

Denmark (month of September).
Anthrax, Swine Erysipelas.

France (month of September).
Anthrax, Blackleg, Foot-and-Mouth Disease (2,747 "étables" in 800 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period October 1st—15th).
Foot-and-Mouth Disease (89 infected places in 20 parishes), Glanders and Farcy, Swine Fever.

Holland (month of September).
Anthrax, Foot-and-Mouth Disease (1 outbreak in 1 province), Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (for the period October 2nd—9th).
Anthrax, Foot-and-Mouth Disease (total of 58 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period October 7th—13th).
Anthrax, Blackleg, Foot-and-Mouth Disease (191 new cases entailing 12,909 animals), Glanders and Farcy, Rabies, Swine Fever.

Montenegro (for the period June 15th—July 1st).
Glanders and Farcy.

Norway (month of September).
Anthrax, Blackleg.

Rumania (for the period October 5th—13th).

Anthrax, Blackleg, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of June).

Anthrax, Foot-and-Mouth Disease (6,231 animals in 174 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period August 3rd—10th).

Anthrax, Sheep-pox.

Spain (month of August).

Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (6,914 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of September).

Anthrax, Blackleg.

Switzerland (for the period October 21st—27th).

Anthrax, Blackleg, Foot-and-Mouth Disease (235 "étables" and "pâturages" entailing 2,648 animals, of which 34 "étables" were declared infected during the period), Swine Fever.

Agricultural Labour in England during October.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts on the demand for agricultural labour in October:—

Agricultural employment was generally regular until the latter part of the month, when in certain districts rain caused loss of time to labourers outside the ordinary farm staff. Such extra men were otherwise in fairly good demand, farm work being somewhat backward, and in a number of districts, particularly in the Midland Counties, the supply of men was below requirements.

Northern Counties.—Men outside the regular farm staff were in fairly good demand in these counties, though employment was interrupted on a few days through rain towards the end of the month in some districts. The principal kinds of work for which they were wanted were potato-lifting, getting up roots, threshing, hedge-trimming, and carting manure; there was also harvest work to be done in several districts, where such work had been prolonged into October. The supply of men was usually equal to the demand, but was below requirements in several districts in *Lancashire* and in the Doncaster (*Yorkshire*) Rural District, while a surplus was reported in the Malton and Patrington (*Yorkshire*) Rural Districts.

Midland Counties.—There was generally a good demand for extra labour for work on the potato and root crops, and threshing and clearing up arrears on the hay and corn harvests, and in a number of districts an insufficient supply of men was reported. Such districts included parts of the Blyth-and-Cuckney (*Nottinghamshire*), Hinckley (*Leicestershire*), Blore Heath, Cannock, Stone; and Tamworth (*Staffordshire*), Market Drayton (*Shropshire*), Droitwich, Evesham, and Pershore (*Worcestershire*), Monks Kirby and Southam (*Warwickshire*), Banbury (*Oxfordshire*), Buntingford (*Hertfordshire*), and Bedford and

Eaton Socon (*Bedfordshire*) Rural Districts. A scarcity of men for permanent situations was reported in the Belper (*Derbyshire*), Upton-on-Severn (*Worcestershire*), Wellingborough (*Northamptonshire*), and Banbury (*Oxfordshire*) Rural Districts.

Eastern Counties.—Extra labourers in these counties were generally in regular employment, being in demand for such work as threshing, raising potatoes and roots, hedging, and ditching. Some scarcity of such men was reported in parts of the Ely (*Cambridgeshire*), Bourne, Grimsby, and Sleaford (*Lincolnshire*), and East and West Flegg, Erpingham, Swaffham, and Thetford (*Norfolk*) Rural Districts; in the Colchester (*Essex*) Rural District a surplus of men was reported.

Southern and South-Western Counties.—Rain caused extra labourers to lose a little time in the latter part of the month in some districts, otherwise such men were in fairly good demand in most districts. The supply was generally about equal to the demand, though some scarcity was reported in parts of the Eltham (*Kent*), Guildford (*Surrey*), Hereford, Newton Abbot (*Devon*), and Camelford (*Cornwall*) Rural Districts. A scarcity of men for permanent situations was reported in the Godstone and Guildford (*Surrey*), Petworth (*Sussex*), Chippenham (*Wiltshire*), Dursley and Stow-on-the-Wold (*Gloucestershire*), Axminster (*Devonshire*), and West Penwith (*Cornwall*) Rural Districts.

THE CORN MARKETS IN OCTOBER.

C. KAINS-JACKSON.

Wheat.—British grain was in under average supply all through the month, and at the same time the condition of deliveries showed steady improvement. The price made for the best English wheat in October has exceeded forty shillings, and seed wheat has been in particularly good request. Of imported kinds of wheat, American, both spring and winter, have had the leading place at about 40*s.* per 480 lb. Indian wheat in its varieties has commanded a steady market all through the month, but trade has been below the average in Argentine, Australian, Californian, and Chilian.

The shipments for the month are:—North America, 1,977,000 qr.; South America, 342,000 qr.; India, 650,000 qr.; Australasia, 125,000 qr.; Russia, 1,520,000 qr.; and Europe S.E., 768,000 qr. So far as these particular figures go, the United States and Canada must be regarded as the leading influence in the new season's trade. Russia's exports, though large, are materially less than in some previous years. In October, 1910, for instance, Russia shipped 3,942,000 qr. The quantity of wheat now on passage, 2,250,000 qr., is a little below the average of the past ten years.

Flour.—The price of Household flour has advanced a shilling per sack on the month, and it has carried with it "Town Whites," with which it is blended for West End consumption, and also the lower grades such as "No. 2," the price of which is nearly always fixed at 1*s.* 6*d.* below Town Households. Flour from the country mills has been sent up to London during October at a rate exceeding that which current demand could easily deal with, and the result has naturally been a certain depreciation in spot value. No changes of importance have taken place in American, Hungarian, or Australian flour, the demand in all three cases having been fair but never large. America has shipped a little more freely than usual, and 264,000 sacks are now on passage from the U.S.A. and Canada. Other shippers are but poorly represented.

Barley.—Maltsters, as usual, have been busy, and they have had better fortune than anticipated. The shows of malting barley at Blandford and Islington did not result in the offer of samples at all up to 1911 standard, but they showed 1912 to be better than was anticipated. The scarcity of fine barley and malt sent up prices for the best samples of each by 4*s.* per qr., yet even at such quotations as 48*s.* per 448 lb. and 336 lb., for best barley and malt respectively, the Continent seems unable to compete. October shipments were 121,000 qr. from North America, 2,590,000 qr. from Russia, 165,000 qr. from Roumania, 90,000 qr. from Turkey (prior to the war prohibitions), and 510,000 qr. from India. The supplies in prospect of feeding corn are ample. The 710,000 qr. of barley now on passage include 80 per cent. of merely feeding quality.

Oats.—Speculative business in 304 lb. oats has been dominated by the offers of new crop Argentine at 17*s.* per qr. Russia has made no efforts to push sales of her admittedly large new crop. The "dark horse" in the oat trade is at this moment America, which last month shipped 942,000 qr. The type chiefly in request at Mark Lane is the clipped kind at 20*s.* to 21*s.* per 320 lb. On the last day of the month 290,000 qr. of oats were on passage. British oats have kept up well in price.

Maize.—Shipments for October were 12,000 qr. from India, 160,000 qr. from Russia, 48,000 qr. from Roumania, and 2,860,000 qr. from South America. The yellow maize of Argentina completely predominated, and when at the end of the month the unique quantity of 1,680,000 qr. was found to be on passage, 1,250,000 qr. of this was classed as the yellow corn of South America. The March crop in La Plata, available for shipment in June, although a good one, was not by any means extremely large. The rush to sell is induced by the good prospects of the new crop in the United States, which will be available for shipment by January 1st or thereabouts. Hence the anxiety to clear the produce already in hand. The leading business in October has been speculative. America has offered new maize for January shipment at 5*s.* 4*d.* per cental. The fine small round maize of the Near East not only remains in request, but has been held with an increased firmness since the political troubles in that region.

Oilseeds.—London has been doing an increased trade in cottonseed, while Hull has been just holding its own. These two ports continue to divide the chief control of this trade between them. There is little prospect of cottonseed being at all cheap, despite the good Egyptian yield. Linseed is cheaper on the month, the competition between India and Argentina, which is normal, being complicated by U.S. and Canadian offers to ship at a price of 52*s.* per 416 lb., or thereabouts. Linseed shipments for October were 150,000 qr. from India, and 149,000 qr. from Argentina. There are now on passage 120,000 qr. of linseed, and 40,000 tons of cottonseed.

Various.—Beet sugar has fallen to 9*s.* 6*d.* per cwt. Rice, on the other hand, continues to command a relatively high price. Canaryseed has recently risen owing to the curtailment of the Turkish supply. White Calcutta peas at 7*s.* per cental seem good value, and also Indian chick peas at 32*s.* per 504 lb. Fine autumn tares have made 88*s.* per qr., and a like price has been paid, without demur, for really good English rapeseed.

THE LIVE AND DEAD MEAT TRADE IN OCTOBER.

A. T. MATTHEWS.

Fat Cattle.—The supplies of live cattle at market have been below the average, and some of those markets where Irish form a considerable proportion under normal circumstances, have this month shown quite a large deficiency. At the metropolitan market, for instance, the absence of cattle from Ireland has made a marked difference. Yet, in spite of the reduction in the numbers of live cattle offered, prices have again shown a decided, though not very serious, downward tendency. The markets all round have clearly been dislocated by the temporary change in the form of the Irish imports. At first sight it might be supposed that it would make little difference whether Irish meat was sent over alive or dead, so long as the total consignments were the same. Owing, however, to the virtual stoppage of the trade in stores a large number of these, which in the ordinary course would have been sold for finishing in English yards and stalls, to come out at Christmas or later, have been hurried off in immature condition for slaughter, and the consequent glut in the dead-meat markets has reacted on those of live stock. The following were the average prices of the various breeds during October:—Shorthorns, 8*s.* 6*d.* and 7*s.* 8*d.* per 14 lb. stone, against 8*s.* 10*d.* and 8*s.* in September; Herefords, 8*s.* 8*d.* and 7*s.* 11*d.*, against 9*s.* and 8*s.* 2*d.*; Devons, 8*s.* 6*d.* and 7*s.* 9*d.*, against 8*s.* 10*d.* and 7*s.* 11*d.*; Welsh Runts, 8*s.* 4*d.* and 7*s.* 8*d.*, against 8*s.* 9*d.* and 8*s.* 1*d.*; and Polled Scots, 8*s.* 10*d.* and 8*s.* 4*d.*, against 9*s.* 1*d.* and 8*s.* 11*d.* Thus prices have receded just about ¼*d.* per lb. all round, doubtless owing to the fact mentioned above. Should this view be correct, we are drawing on our winter supplies, which must be thus far diminished.

Veal Calves.—The average price of veal calves in about twenty English and Scotch markets was 8¼*d.* per lb. for first, and 7½*d.* for second quality. Values again varied widely, ranging for prime quality from 10*d.* at Edinburgh, and 9*d.* at several other places, down to 7¾*d.* at Shrewsbury.

Fat Sheep.—The month of October marks the end of one season and the commencement of another in the English markets for fat sheep. The season for lamb has come to an end; the shearling wethers are becoming exhausted, and their place is gradually being filled up by what are now classed as tegs or hoggs. Very considerable numbers have appeared at Islington, the first coming forward in the second week. They are chiefly Hampshires, which have been well fed from the start, and finished off on rape or early turnips. They weigh from 50 to 60 lb., and are easily disposed of to suburban butchers, who appreciate their fine quality and small joints. They have been selling at as much as 9½*d.* per lb., while 80-lb. shearings have only realised 8½*d.* Average prices for England have fairly held their own, and work out at 8½*d.*, 7½*d.*, and 6*d.* per lb. for Downs, and 8*d.*, 7¼*d.*, and 5½*d.* for Longwools. On comparing these prices with those of September, the only difference is a decline of about ¼*d.* in the average price of first quality Longwools and second quality Downs. The remarks in connection with the Irish supplies of cattle apply in almost equal measure to sheep, the rougher qualities being especially affected.

With the advent of young sheep, and the growing value of skins, it is reasonable to expect some advance in the average quotations of prices per lb. in the coming weeks. Fat ewes and heavy, coarse wethers are now low in proportion to first quality.

Fat Pigs.—The value of bacon pigs rather more than maintained the comparatively high level of September, appreciating to the extent of about 2*d.* per 14 lb. stone. The average in over thirty British markets was 7*s.* 11*d.* per stone for prime small, and 7*s.* 3*d.* for heavier pigs. An examination of the official returns will generally show a wide range of prices at the various centres. In the week ending October 23rd, prime pigs were fetching 8*s.* 7*d.* per stone at Salford, 8*s.* 5*d.* at Birmingham, Basingstoke, and Wolverhampton, against 7*s.* 6*d.* at Penzance, 7*s.* 10*d.* at Bristol and Gloucester, and 7*s.* 9*d.* at Lincoln. Prices in Scotland were considerably lower than in England.

Carcass Beef—British.—The supplies of Scotch and English sides have been very meagre in London markets—often only a few long sides of the former, and on some days none at all. English ox-beef was also frequently entirely absent. Short Scotch sides averaged 4*s.* 8*d.* to 4*s.* 11*d.*, according to quality, and the little English on offer in the last two weeks made 3*s.* 7*d.* to 3*s.* 10*d.* per 8 lb. The better class of Irish—which has completely dominated the market—averaged 3*s.* 7*d.* and 3*s.* 4*d.*, but there have been large quantities of inferior meat sold at such low figures as to drive down the value of even chilled and frozen descriptions.

Port-Killed Beef.—There has been no North American beef on offer at Smithfield, and that coming from Ireland is referred to above.

Chilled Beef.—The price of chilled Argentine beef has declined all the month, and this is attributed entirely to the heavy supplies of Irish. Hindquarters averaged 3*s.* 3*d.* and 2*s.* 10*d.*, against 3*s.* 4*d.* and 3*s.* in September, and fores, 2*s.* 3*d.* and 2*s.* per 8 lb., against 2*s.* 4*d.* and 2*s.* 2*d.*

Frozen beef.—Argentine "hard" beef averaged 2*s.* 6*d.* and 2*s.* 4*d.* for hindquarters, and 1*s.* 11*d.* and 1*s.* 9*d.* for fores, New Zealand fetching about 1*d.* per 8 lb. more. Trade in this article has been very quiet owing to the Irish competition.

Carcass Mutton—Fresh-Killed.—London markets have been too heavily supplied with fresh-killed mutton, including a good deal of very fair quality from Ireland. Scotch made ¼*d.* per lb. less than in September, and English ½*d.* less, Dutch also declining to about the same extent. Irish mutton made from 3*s.* to 4*s.* per stone, according to quality. Scotch carcasses averaged 4*s.* 9*d.* and 4*s.* 5*d.* for first and second quality, English 4*s.* 2*d.* and 3*s.* 10*d.*, and Dutch 3*s.* 11*d.* and 3*s.* 7*d.* per 8 lb. stone.

Frozen Mutton and Lamb.—Frozen mutton also declined in value to the extent of about ¼*d.* per lb. The best New Zealand averaged 3*s.* 1*d.* and 2*s.* 9*d.*, and Australian 2*s.* 10*d.* and 2*s.* 8*d.* per stone. Lamb supplies have been almost entirely confined to New Zealand, and this averaged 3*s.* 10*d.* and 3*s.* 8*d.*, showing a decline of ⅜*d.* compared with September prices. Australian and Argentine "lamb" cannot properly be classed as such at this season, but some "new season" produce from Argentina will shortly be on offer.

Veal.—British veal of best quality has been scarce, and first and second quality averaged 5*s.* 2*d.* and 4*s.* 8*d.*, but it should be clearly understood that the proportion of the total supplies fetching these prices was very small. The bulk of the veal shown was very inferior, and sold at very poor prices.

Pork.—Until the last week the demand for pork was very good, and September prices continued to prevail, viz., 5*s.* 4*d.* and 4*s.* 10*d.* per stone. At the end of the month the general dullness of the market affected pork, and prices fell about ½*d.* per lb.

THE PROVISION TRADE IN OCTOBER.

HEDLEY STEVENS.

Bacon.—Prices for all descriptions of pig products remained very high until about the third week of the month, when all prices commenced to decline. The drop in prices of long sides in some cases shows a reduction of some shillings per cwt. during the month, and even with this substantial decline, prices for long sides are still about 12*s.* to 13*s.* per cwt. above those current at the end of October last year.

The killings in Denmark have somewhat rapidly increased, those in the last three weeks being 37,000, 44,000 and 52,000 pigs weekly; also the killings in Ireland have been heavy on account of the continued restriction on shipments of live pigs from that country. Imports from all other points have been extremely small for the time of year, especially from the United States of America and Canada, but during the latter half of October the receipts of hogs at most packing centres in the former country showed heavy increases, and in consequence prices fell heavily, ranging from $9.35 early in the month to $7.00 by the end. The prices in the same month of last year ranged from $5.70 to $6.80. It is thought by those who claim to be well posted that a reaction in prices must soon follow, and we cannot expect any permanent reduction in prices until the spring of next year. English curers continue to complain of the small quantities of suitable English pigs available. Prices are good, and with feeding-stuffs cheaper, should encourage breeders to increase their holdings.

Cheese.—On account of the extremely high prices, trading during the entire month has been most unsatisfactory and disappointing for all concerned, although present prices of English are from 10*s.* to 13*s.*, and of Canadian 5*s.* to 6*s.* per cwt. under prices current at the same time last year, when the conditions were entirely different owing to the hot, dry weather, and consequent small make of cheese.

The shipments from Canada are considerably behind those of last year for the same period (about 130,000), but this shortage has been somewhat discounted by the largely increased make in England during this season, and this year's English make being proportionately cheaper, it has been more extensively consumed in place of Canadian. New Zealand cheese in regular monthly deliveries, say, from January to July, has been offered at less money, from 64*s.* to 65*s.* c.i.f., but with the anticipated largely increased make importers are shy of contracting, and as the New Zealand makers refuse to reduce their ideas of values, most of the present season make will be consigned, to be sold at market values on arrival.

Stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 351,000 boxes, against 340,000 at the end of October, 1911, and 426,000 in 1910.

In the United States of America prices of cheese are very high, finest skims making prices near those for full-cream Canadians.

Butter.—The demand for butter has been of a "hand-to-mouth" character throughout the month, and prices for some descriptions have gradually declined.

The high prices prevailing have curtailed consumption of finest goods, and secondary lots have been neglected, as margarine is better value. As usual at this time of year, the make in Ireland has fallen off considerably, and as it is early for any quantity of Colonial to be on the market, the month's trade has been mostly in Danish and Siberian.

Very few New Zealand butters have been contracted for this season, and in consequence most of the output for the next six months will be consigned to English houses. Vancouver buyers are reported to have contracted 3,000 tons, and will want more.

Canada and the United States of America continue to consume all their make of butter, and at prices beyond an export basis.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of October, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	ENGLAND.		SCOTLAND.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Polled Scots	8 10	8 4	45 7	41 0
Herefords	8 8	7 11	—	—
Shorthorns	8 6	7 8	44 7	40 1
Devons	8 6	7 9	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	8¼	7½	8½	7
Sheep:—				
Downs	8½	7½	—	—
Longwools	8	7¼	—	—
Cheviots	8¾	7¾	8½	7¾
Blackfaced	8	7¼	7¾	7
Cross-breds	8¼	7½	8¾	7¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Bacon Pigs	8 0	7 7	7 5	6 6
Porkers	8 4	7 10	7 10	6 11
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ *s.*	£ *s.*	£ *s.*	£ *s.*
Shorthorns—In Milk ...	22 18	19 2	23 16	19 17
,, —Calvers... ...	21 14	18 14	23 2	19 0
Other Breeds—In Milk ...	18 19	16 18	22 2	17 10
,, —Calvers ...	17 12	16 0	22 5	18 12
Calves for Rearing	2 6	1 15	2 9	1 14
Store Cattle:—				
Shorthorns—Yearlings ...	11 2	9 7	13 9	11 4
,, —Two-year-olds...	15 3	13 2	18 17	16 0
,, —Three-year-olds	18 16	16 8	—	—
Polled Scots—Two-year-olds	—	—	19 3	16 10
Herefords— ,,	16 6	14 3	—	—
Devons— ,,	13 12	11 17	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Downs or Longwools ...	36 4	30 2	—	—
Scotch Cross-breds ...	—	—	26 6	23 4
Store Pigs:—				
8 to 10 weeks old	18 6	14 5	19 10	16 1
12 to 16 weeks old	29 3	21 11	—	—

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of October, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Liverpool.		London.		Manchester.		Edinburgh.		Glasgow.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
BEEF :—		*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
English	1st	53	6	48	0	53	6	51	0	63	6*	67	6*
	2nd	49	0	43	6	50	0	48	6	53	6*	49	6*
Cow and Bull ...	1st	49	0	42	6	44	0	44	6	50	6	48	6
	2nd	41	0	37	6	39	0	39	6	42	0	43	6
Irish :—													
Port Killed ...	1st	49	0	47	0	50	6	48	6	54	6	54	6
	2nd	44	6	42	6	48	0	46	0	46	6	47	0
Argentine Frozen—													
Hind Quarters...	1st	35	0	35	6	35	0	35	6	37	6	35	0
Fore ,, ...	1st	26	6	27	6	27	0	27	6	28	0	28	0
Argentine Chilled—													
Hind Quarters...	1st	45	0	42	0	45	6	42	0	47	6	44	6
Fore ,, ...	1st	30	6	29	0	31	6	29	0	33	0	31	6
Australian Frozen—													
Hind Quarters...	1st	34	6	33	0	34	0	33	0	—		35	0
Fore ,, ...	1st	28	6	26	6	25	6	26	6	—		28	0
VEAL :—													
British	1st	—		74	6	72	6	76	0	—		71	0
	2nd	63	0	65	6	65	6	71	0	—		66	6
Foreign	1st	—		—		76	0	—		71	6	70	0
MUTTON :—													
Scotch	1st	—		—		66	6	69	0	63	6	68	6
	2nd	—		—		61	6	64	0	54	0	45	6
English	1st	64	6	60	6	59	0	65	0	—		—	
	2nd	56	0	54	0	54	0	60	6	—		—	
Argentine Frozen ...	1st	40	6	40	0	39	6	39	6	41	6	40	6
Australian ,, ...	1st	39	0	38	6	39	0	38	0	—		38	0
New Zealand ,, ...	1st	41	0	—		43	6	—		—		—	
LAMB :—													
British	1st	65	6	63	0	67	0	64	6	65	6	68	0
	2nd	60	0	56	0	62	6	59	6	52	6	54	0
New Zealand ...	1st	56	0	54	0	54	0	54	0	—		54	0
Australian	1st	48	6	47	0	50	0	47	0	—		46	6
Argentine	1st	45	6	46	6	—		47	0	—		46	6
PORK :—													
British	1st	70	0	74	6	73	0	75	6	67	0	64	0
	2nd	65	6	65	6	66	6	71	0	60	0	60	0
Foreign	1st	—		—		68	0	—		—		—	

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6 ...	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
" 13 ...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
" 20 ...	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
" 27 ...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3 ...	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
" 10 ...	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
" 17 ...	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
" 24 ...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2 ...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
" 9 ...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
" 16 ...	32	6	30	1	34	0	23	6	24	11	31	2	18	0	17	6	21	8
" 23 ...	32	9	30	2	34	1	23	7	25	0	31	10	17	11	17	5	21	9
" 30 ...	33	0	30	3	34	4	23	8	24	11	30	3	18	0	17	5	21	8
Apl. 6 ...	33	6	30	4	34	10	23	1	24	7	30	9	17	11	17	7	21	11
" 13 ...	33	7	30	3	35	4	23	5	25	2	30	2	18	3	18	3	22	1
" 20 ...	33	7	30	4	36	7	23	0	25	5	29	11	18	3	17	10	22	4
" 27 ...	33	0	30	11	37	10	22	10	25	5	30	4	18	3	18	3	22	9
May 4 ...	32	6	31	4	38	1	22	7	25	7	30	2	18	2	18	6	23	1
" 11 ...	32	1	31	8	37	11	22	0	25	1	31	1	18	1	19	0	23	7
" 18 ...	31	10	32	6	37	8	21	8	25	4	31	2	17	8	19	2	23	7
" 25 ...	31	3	32	8	37	2	21	4	25	0	31	1	17	10	19	5	23	7
June 1 ...	30	2	32	5	36	10	21	8	24	10	30	0	17	10	19	5	23	9
" 8 ...	29	1	32	4	36	11	20	9	25	7	29	11	17	10	19	7	24	0
" 15 ...	29	0	32	3	37	0	18	11	23	11	30	8	18	0	19	8	23	10
" 22 ...	29	4	31	11	37	5	20	1	23	9	30	8	17	9	19	10	24	0
" 29 ...	29	9	31	10	37	10	19	11	24	5	30	2	17	7	19	9	23	11
July 6 ...	30	4	32	1	38	2	19	5	25	10	31	7	17	4	19	9	23	11
" 13 ...	31	1	32	3	38	3	21	3	25	10	30	2	17	7	19	11	24	1
" 20 ...	31	11	32	5	38	10	19	9	24	3	30	9	17	5	19	5	24	8
" 27 ...	33	5	32	5	38	9	20	10	23	8	30	9	18	1	19	7	23	4
Aug. 3 ...	33	9	32	0	38	4	20	5	24	4	28	6	18	3	18	2	22	2
" 10 ...	33	5	31	6	39	2	20	4	26	9	30	7	18	0	18	0	22	4
" 17 ...	32	11	31	6	38	2	20	11	27	8	28	3	17	11	17	10	21	8
" 24 ...	32	7	31	8	35	6	20	10	28	10	28	1	17	2	18	0	20	10
" 31 ...	32	2	31	7	34	10	22	10	28	4	28	6	17	2	18	3	20	8
Sept. 7 ...	31	11	31	10	35	1	23	3	28	4	29	9	17	2	18	1	21	8
" 14 ...	30	11	32	0	33	5	24	3	29	0	29	0	16	6	18	5	20	5
" 21 ...	30	2	32	4	32	7	24	2	29	11	29	6	16	3	18	9	19	10
" 28 ...	30	1	32	6	31	7	24	4	30	5	29	9	16	4	19	1	19	5
Oct. 5 ...	30	1	32	7	31	8	24	7	30	9	29	7	16	3	19	5	19	8
" 12 ...	30	2	32	9	31	10	25	1	31	0	30	4	16	2	19	10	19	5
" 19 ...	30	4	32	9	32	2	25	3	31	5	30	11	16	1	19	11	19	9
" 26 ...	30	4	33	1	33	1	25	4	31	7	31	6	16	2	20	6	19	10
Nov. 2 ...	30	4	33	4	33	4	25	6	31	10	31	10	16	2	20	8	20	1
" 9 ...	29	11	33	4	33	1	25	4	32	7	31	11	15	11	20	11	19	11
" 16 ...	29	8	33	1			25	1	32	10			16	1	21	0		
" 23 ...	29	11	33	0			24	10	33	5			16	4	20	10		
" 30 ...	30	6	32	10			24	7	33	10			16	7	20	11		
Dec. 7 ...	30	9	32	9			24	3	34	0			16	9	20	9		
" 14 ...	30	7	32	11			23	9	33	5			16	10	20	9		
" 21 ...	30	7	32	9			23	10	33	5			16	9	20	8		
" 28 ...	30	5	33	0			23	9	33	4			16	9	20	7		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.				BARLEY.				OATS.			
		1911.		1912.		1911.		1912.		1911.		1912.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
France:	September	42	8	45	7	26	11	29	11	21	8	23	2
	October	43	0	46	6	27	7	30	0	21	11	23	6
Paris:	September	43	6	47	2	27	0	30	10	22	10	22	7
	October	43	7	48	7	26	10	30	10	22	8	24	7
Belgium:	August	33	8	36	5	25	4	28	10	20	10	25	3
	September	34	2	35	7	26	7	30	0	22	3	25	7
Germany:	August	42	4	44	8	30	6	31	0	23	1	24	6
	September	43	4	43	4	33	4	32	9	24	4	24	0
Berlin:	August	43	6	45	4	—		—		23	7	25	1
	September	44	2	45	11	—		—		25	4	25	2
Breslau:	August	39	7	41	6	29 24	10* 9†	31 29	2* 4†	22	11	25	9
	September	40	10	39	10	30 24	8* 9†	31 28	10* 11†	23	2	27	3

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of October, 1911 and 1912.

—	WHEAT.				BARLEY.				OATS.			
	1911.		1912.		1911.		1912.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
London	33	9	34	2	32	6	31	7	21	4	21	4
Norwich	32	9	33	2	31	3	28	9	19	11	19	10
Peterborough	32	5	29	7	31	3	29	5	20	6	18	4
Lincoln	32	5	29	9	31	10	30	6	20	10	20	9
Doncaster	32	9	29	6	30	9	28	11	19	11	19	9
Salisbury	31	10	34	6	29	7	31	5	19	6	20	4

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of October, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	14 0	12 9	—	—	15 0	13 9	16 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	126 6	124 6	126 6	124 0	127 6	125 0	125 0	—
,, Factory ...	108 0	102 0	105 0	95 0	112 0	106 0	—	—
Danish ...	—	—	132 6	129 6	132 0	130 0	128 0	—
French ...	—	—	—	—	125 0	119 0	—	—
Russian ...	113 0	107 0	112 6	107 0	115 0	113 0	109 6	—
Australian ...	117 0	113 0	119 0	115 0	120 6	118 0	—	—
New Zealand	—	—	—	—	—	—	—	—
Argentine ...	—	—	124 0	122 0	126 0	124 0	—	—
CHEESE :—								
British—								
Cheddar ...	76 0	72 0	74 0	72 0	75 0	72 0	71 6	69 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	75 0	70 0	79 0	75 6	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	66 0	64 0	66 6	64 0	66 0	65 0	66 6	66 0
BACON :—								
Irish	79 6	74 0	78 0	74 0	79 6	77 0	74 6	—
Canadian ...	75 0	73 0	74 0	72 0	75 0	73 0	75 6	73 6
HAMS :—								
Cumberland ...	—	—	—	—	104 6	98 0	—	—
Irish	—	—	—	—	101 0	93 0	95 0	93 0
American (long cut)	66 6	64 0	69 0	65 6	68 0	65 0	68 6	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	—	—	—	—	17 1	15 7	15 7	—
Irish	13 5	12 8	12 7	11 4	14 8	13 3	13 5	12 5
Danish ...	—	—	12 7	11 7	13 11	12 10	13 1	12 8
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
Edward VII.	92 0	82 0	71 6	66 6	93 0	84 0	—	—
Langworthy ..	100 0	95 0	95 0	86 6	100 0	91 0	78 0	71 0
Up-to-Date ...	87 6	73 0	68 6	63 6	90 0	80 0	68 0	55 0
HAY :—								
Clover ...	102 0	85 0	122 6	100 0	130 0	103 0	87 0	79 6
Meadow ...	96 0	80 0	—	—	119 6	97 0	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	45	75	639	723
Animals attacked	46	92	721	895
Foot-and-Mouth Disease :—				
Outbreaks	1	9	82	18
Animals attacked	3	26	636	467
Glanders (including Farcy) :—				
Outbreaks	9	24	148	177
Animals attacked	13	51	273	419
Parasitic Mange :—				
Outbreaks	59	—	2,480	—
Animals attacked	75	—	5,314	—
Sheep-Scab :—				
Outbreaks	9	5	186	316
Swine-Fever :—				
Outbreaks	134	160	2,479	2,081
Swine Slaughtered as diseased or exposed to infection ...	2,500	2,468	33,497	24,815

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	—	—	3	7
Animals attacked	—	—	3	14
Foot-and-Mouth Disease :—				
Outbreaks	36	—	65	—
Animals attacked	99	—	360	—
Glanders (including Farcy) :—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	3
Parasitic Mange :—				
Outbreaks	6	1	58	53
Sheep-Scab :—				
Outbreaks	19	16	286	281
Swine-Fever :—				
Outbreaks	8	9	194	113
Swine Slaughtered as diseased or exposed to infection ...	72	158	1,581	1,923

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Russell, E. J.—Soil Conditions and Plant Growth. (168 pp.) London: Longmans, Green and Co., 1912. 5*s.* net. [63.113; 63.161.]

"*Home Counties*" (*J. W. Robertson Scott*).—A Free Farmer in a Free State: A Study of Rural Life and Industry and Agricultural Politics in an Agricultural Country [Holland]. (xx. + 335 pp. + plates and map.) London: William Heinemann, 1912. 6*s.* net. [63(492).]

Passy, L.—Histoire de la Société Nationale d'Agriculture de France. Tome Premier (1761–1793). (475 pp.) Paris: Philippe Renouard, 1912. [63(44); 63.062.]

Deutsche Landwirtschafts-Gesellschaft.—Arbeiten. Heft 216:—Verbrauch an reinen Kali in den Jahren 1890, 1900 und 1910. (55 pp. + 12 maps.) [63.1673.] Heft 217:—Weitere Versuche über die Wirkung verschiedener Stickstofformen aus den Jahren 1908–1911. (171 pp.) [63.1671.] Heft 220:—Die Bekämpfung des Unkrautes. Stück VI. Die gemeine Quecke (*Agriopyrum repens*, P. B.). (152 pp.) [63.259.] Berlin: Paul Parey, 1912.

*International Institute of Agriculture.**—The Science and Practice of Farming during 1910 in Great Britain (England, Wales, and Scotland) as seen through the Scientific and Agricultural Press. (646 pp.) Rome, 1910. [63(42).]

Wisconsin Agricultural Experiment Station.—Research Bull. 14:—Sulphur requirements of Farm Crops in Relation to the Soil and Air Supply. (21 pp.) Madison, Wis., 1911. [63.161.]

Oldenburg, G.—Das landwirtschaftliche und zweckverwandte Unterrichtswesen im Königreich Preussen, zugleich landwirtschaftliche Schulstatistik für die Jahre 1906, 1907 und 1908. (786 pp.) Berlin, 1910. [37(43).]

Bæhler, E.—Beiträge zur Geschichte und Darstellung des schweizerischen landwirtschaftlichen Unterrichts. (170 pp.) Bern, 1911. [37(494).]

Gregson, Margaret M.—The Story of Our Trees in Twenty-four Lessons. (160 pp.) Cambridge: University Press, 1912. 2*s.* 6*d.* net. [371; 63.49 : 58.]

Ohio Agricultural Experiment Station.—Circ. 123:—Carriers of Lime. (135–142 pp.) Wooster, Ohio, 1912. [63.15.]

Field Crops—

Denbigh, Earl of.—Beet Sugar as a British Industry. (54 pp.) London: National Sugar Beet Association, 1912. 2*d.* [63.3432 : 664.1.]

Nebraska Agricultural Experiment Station.—Bull. 125:—Wheat Breeding Experiments. (16 pp.) Lincoln, Neb., 1912. [63.311; 63.1952.]

Deutsche Landwirtschafts-Gesellschaft.—Arbeiten. Heft 208:—I., Züchtung und Samenbau von Klee und Gräsern in Dänemark und Sweden. II., Landwirtschaftliche Reisebilder aus Skandinavien. (121 pp.) [63.33(*b*); 63(4).] Heft 215:—Drei- und vierjährige Hafer-Anbauversuche (1905–1907 und 1905–1908). (734 pp.) [63.314.] Berlin: Paul Parey, 1912.

Missouri Agricultural Experiment Station.—Circular 56:—Some Factors in Wheat Production. (167–177 pp.) Columbia, Missouri, 1912. [63.311.]

Trinidad and Tobago, Department of Agriculture.—Circ. 13:—Tobacco Cultivation in Tobago. (18 pp.) [63.3461.]

Colorado Agricultural Experiment Station.—Bull. 183:—Deterioration in the Quality of Sugar Beets due to Nitrates formed in the Soil. (197 pp.) Fort Collins, Colorado. [63.3432.]

Ohio Agricultural Experiment Station.—Bull. 238:—Tobacco Culture in Ohio: Results of Investigations from 1903 to 1910. (263–359 pp.) Wooster, Ohio, 1912. [63.3461.]

West of Scotland Agricultural College.—Bull. 60:—Report on Experiments on the Manuring of Turnips in 1909, 1910 and 1911. (39 pp.) Glasgow, 1912. [63.332.]

Punjab, Dept. of Agriculture.—Bull. 1 of 1910:—The Cultivation of "Stronger" and More Valuable Wheats for Export from the Punjab. (10 pp.) Lahore, 1910. [63.311.]

Horticulture—

Hooper, C. H.—Fruit Farming: Practical and Scientific for Commercial Fruit Growers and Others. (130 pp.) London: The Lockwood Press, 1912. 3*s.* 6*d.* net. [63.41(02).]

Deutsche Landwirtschafts-Gesellschaft.—Arbeiten. Heft 213:—Beiträge zur Kultur des Kopfkohls. (44 pp.) Berlin: Paul Parey, 1912. [63.511.]

Bunyard, G.—Apples and Pears. (116 pp. + viii. plates.) [Present-Day Gardening, No. 9.] London: T. C. and E. C. Jack, 1911. 1*s.* 6*d.* net. [63.41(*a*).]

Plant Diseases—

Wisconsin Agricultural Experiment Station.—Research Bull. 15:—Experiments on Spore Germination and Infection in certain Species of Oomycetes. (25–91 pp. + x. plates.) 1911. [63.24.(04).] Research Bull. 18:—A Sclerotium Disease (*Sclerotium rhizodes*) of Blue Joint and other Grasses. (207–261 pp. + viii. plates.) 1911. [63.24.] Circ. of Information 36:—Potato Diseases in Wisconsin and their Control. (10 pp.) 1912. [63.27–33; 63.24–33.] Madison, Wisconsin.

Swanton, E. W.—British Plant Galls: A Classified Text-book of Cecidology. (287 pp. + xxxii plates.) London: Methuen and Co., 1912. 7*s.* 6*d.* net. [63.22.]

Ohio Agricultural Experiment Station.—Bull. 232:—Spray Calendar for the Treatment of Plant Diseases and Insect Pests. (23–52 pp.) 1911. [63.294.] Bull. 233:—Fall Manual of Practice in Agricultural Zoology. (53–164 pp.) 1911. [63.27(04).] Bull. 234:—Flour Mill Fumigation. (171–184 pp.) 1912. [63.27–31; 63.294.] Wooster, Ohio.

Lister, A., and *Lister, G.*—A Monograph of the Mycetozoa: A Descriptive Catalogue of the Species in the Herbarium of the British Museum. [2nd edition.] (302 pp.+201 plates.) London: Longmans and Co., 1911. [63.24(02).]

Delaware Agricultural Experiment Station.—Bull. 97:—Plant Protection. (78 pp.) Newark, Delaware, 1912. [63.29.]

Live Stock—

Nebraska Agricultural Experiment Station.—Bull. 130:—Forage Rations for Growing Horses. (15 pp.) Lincoln, Neb., 1912. [63.61.]

South Dakota Agricultural Experiment Station.—Bull. 136:—Fattening Pigs. (337–350 pp.) Brookings, South Dakota, 1912. [63.64.]

Wyoming Agricultural Experiment Station.—Bull. 93:—A Comparison of Sheep Branding Paints. (8 pp.) Laramie, Wyo., 1912. [63.63.]

Lydekker, R.—The Sheep and its Cousins. (315 pp. + 24 plates.) London: G. Allen and Co., 1912. 10*s.* 6*d.* net. [59.9; 63.63.]

New South Wales Dept. of Agriculture.—Farmers' Bull. 53:—Sheep and Wool for the Farmers. Part I., The Crossbreeding of Sheep. (126 pp.) Sydney, 1912. [63.63.]

Dairying and Food, General—

Deutsche Landwirtschafts-Gesellschaft.—Arbeiten. Heft 210:—Bericht über die Hauptprüfung von Tiefkühlern der Wanderaustellung der D. L. G. zu Cassel 1911. (24 pp. + Tafel 1.) [63.713.] Heft 211:—Vorprüfung neuer milchwirtschaftlicher Geräte. I., Berichte über die Prüfung dreier Melkmaschinen. (107 pp.) [63.713.] Heft 219:—Vorprüfung neuer milchwirtschaftlicher Geräte. II., Folge der Prüfungsberichte. (101 pp.) [63.713.] Berlin: Paul Parey, 1912.

Wisconsin Agricultural Experiment Station.—Bull. 226:—The Wisconsin Dairy Cow Competition. (36 pp.) Madison, Wisconsin, 1912. [63.711.]

O'Callaghan, M. A.—Dairying in Australia: Farm and Factory. (741 pp.) Sydney: Angus and Robertson, 1912. 10*s.* [63.7(9); 63.70(02).]

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Circ. 199:—The Score-Card System of Dairy Inspection. (32 pp.) [614.94.] Circ. 200:—A Simple Butter Colour Standard. (3 pp.) [543.2.] Washington, 1912.

U.S. Dept. of Agriculture.—Farmers' Bull. 490:—Bacteria in Milk. (23 pp.) Washington, 1912. [576.8.]

Ohio Agricultural Experiment Station.—Circ. 128:—Feeding Dairy Cows. (183–212 pp.) Wooster, Ohio, 1912. [63.711.]

Dairy Students' Union.—Dairying and Dairy Farming (ed. by *J. C. Newsham*). (366 pp.) London: "Dairy World" Office. [1912.] 5*s.* net (to Non-Members). [63.70(02).]

New York State Dept. of Agriculture.—Bull. 18:—Certified Milk in New York. (88 pp.) Albany, N.Y., 1910. [614.32.]

Long, J.—Dairy Farming for Smallholders. (142 pp.) London: C. Arthur Pearson, 1912. 2*s.* 6*d.* net. [63.70(02).]

Veterinary Science—

Kansas Agricultural Experiment Station.—Bull. 182:—Vaccination against Hog Cholera. (440–464 pp.) Manhattan, Kan., 1912. [619.4.]

Wisconsin Agricultural Experiment Station.—Circ. of Information, 39:—Directions for Vaccinating against Hog Cholera. (11 pp.) Madison, Wisconsin, 1912. [619.4(*a*).]

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Circ. 201 [Revision of Circ. 144].—Tuberculosis of Hogs. (40 pp.) Washington, 1912. [614.5; 619.4.]

Craig, J. F.—Fleming's Veterinary Obstetrics: including the diseases and accidents incidental to pregnancy and parturition. [3rd Edition.] (528 pp.) London: Baillière, Tindall and Cox, 1912. 15*s.* net. [619(02).]

U.S. Dept. of Agriculture.—Farmers' Bull. 498:—Methods of Exterminating the Texas-Fever Tick. (48 pp.) Washington, 1912. [619.2(*e*).]

Birds, Poultry, and Bees—

Shipley, A. E.—Grouse Disease. (27 pp.) Privately printed, 1911. [63.9.]

British Columbia, Dept. of Agriculture.—Bull. 39:—Natural and Artificial Incubation and Brooding. (16 pp.) Victoria, B.C., 1912. [63.651.]

Tegetmeier, W. B.—Pheasants: Their Natural History and Practical Management. [5th Edition.] (268 pp.) London: Horace Cox, 1911. 7*s.* 6*d.* net. [63.9.]

Forestry—

Hawley, R. C., and *Hawes, A. F.*—Forestry in New England: A Handbook of Eastern Forest Management. (479 pp. + map.) New York: John Wiley and Sons [London: Chapman and Hall], 1912. 15*s.* net. [63.49(73).]

Record, S. J.—Identification of the Economic Woods of the United States; including a discussion of the Structural and Physical Properties of Wood. (117 pp. + vi. plates.) New York: John Wiley and Sons [London: Chapman and Hall], 1912. 5*s.* 6*d.* [63.49(73); 63.49–198.]

[Books may be borrowed from the Board's Library on certain conditions which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P. 10–9. 6,000. 11/12. R. C. & S., Ltd.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE

Vol. XIX. No. 9.

DECEMBER, 1912.

CHICKEN REARING ON AN INTENSIVE SYSTEM.

DURING the spring and summer of 1912 an interesting trial of an intensive system of rearing of chickens for the table was conducted in the neighbourhood of London by a gentleman (Mr. F. G. Paynter) who has supplied detailed information as to his methods and financial returns. The aim was to produce first-class table chickens at a minimum cost and under conditions which would obtain on an average small holding; and though it is, of course, impossible to draw definite conclusions from one year's work, an account of the details of management and the results up to the present can hardly fail to be of interest to small holders and to poultry keepers generally. It is perhaps necessary to add that the lines of management followed were those which had been found successful in similar trials conducted during the previous five or six years.

The "holding" on which the work was done consists of a grass field 3½ acres in extent; the soil is of a fairly light character and is well drained, while the field is comparatively well sheltered by trees and hedgerows, but no natural shelter exists in the runs, and this fact may possibly account to some extent for a comparatively high death-rate among the chickens during the hot weather in July. An essential feature of the management was the fact that no adult birds were kept; this enables the holder to devote all his attention to the chickens, and, to a very great extent—perhaps more than will be realised by those who have not tested the point—reduces the risk of outbreaks of infectious disease. The object was to produce from 100 to 120 chickens a week, this number, with careful and methodical management, being estimated to occupy the greater part of a small holder's time during the spring and summer months. It is important that incubation should begin in December, so as to have the first chickens hatched at the beginning of January; but owing to unavoidable delay, hatching this year did not commence until the 13th February. The experience gained in the previous trials had shown that, owing both to low prices and to chickens thriving unsatisfactorily in autumn, it is not advisable to continue hatching after the end of June. As the chickens are sold at the age of from twelve to sixteen weeks, the small holder has under this system two or three months in which he can pursue other occupations, and during two or three of the remaining months only part of his time is occupied with poultry. Another very important consequence of this arrangement is that the ground is entirely freed from poultry for several months in each year, and if 7 or 8 acres are available it would be possible to change the site of the pens each year, so that the ground would receive a rest of about eighteen months for every six months that it was occupied by poultry. In the intervening seasons a crop of hay might be secured.

As no adult stock are kept, arrangements were made to purchase eggs of breeds fairly suitable for table purposes; in 1912 it was found that on an average two eggs were required for every chicken reared. For hatching, four incubators were required, three being in constant use and one reserved for emergencies. Chickens were kept in foster-mothers for the first six or eight weeks, and afterwards placed in the runs. Considerable attention was given to the method of heating and ventilating the foster-mothers, in order that the heated atmosphere within them might not prove injurious to the chickens. The success of the system depends to no small extent on the exercise of thought and care in this matter. Each run was about 12 yards by 100 yards, and accommodated one week's hatching, that is, from 100 to 120 chickens. In each run two small Sussex chicken "arks" provided sleeping accommodation. These were provided with slatted floors and a pair of wheels, and could be moved readily from place to place.

Feeding.—The preparation of the food and the feeding of the birds were carried out very carefully and systematically, and every effort was made to reduce the amount of labour. No trough feeding or cramming was practised, and only those foods which could be purchased in bulk in any part of the country were used, while advantage was taken of fluctuation in market rates, so that *fresh* material of the very best quality was obtained at economical prices. Without going into details, the character of the feeding can be roughly indicated by placing the different foods used in order according to the quantity consumed during the season:—Wheat 10,978 lb., fine sharps 7,888 lb., biscuit meal 3,257 lb., barley meal 1,827 lb., meat meal and green bone 1,586 lb., bran 1,224 lb., maize 703 lb., rice 370 lb., oatmeal 359 lb., and fat 28 lb.; in addition about 2,000 lb. of mixed chick feed was used. It may be noted that milk formed no part of the regular diet, as it could not be obtained at a reasonable price. The food for each pen was weighed or measured, and careful observation made as to whether the quantity was readily cleared up or not, so that suitable adjustment could be made at the following meal. An ample supply of sharp flint grit was provided, and water was supplied in earthenware troughs. In the runs, despite the heavy stocking, a good growth of grass was always available for the birds.

If, as had been intended, operations could have commenced in December, the first consignment of chickens would have been ready to sell early in April; owing, however, to circumstances already mentioned, marketing did not commence until 28th May. Special importance is attached to sales in the earlier part of the year, as the best prices are obtained in April and May, and poulterers accept much smaller birds at that time, entailing a smaller expenditure of food. It is interesting to note that the estimated profits per bird gradually diminish as the season advances. Exact accounts were kept of all expenditure and receipts, and as all the chickens were sold by 1st November, it is possible to obtain very accurate information as to the returns. Briefly summarised, these were as follows:—

Hatching commenced on February 13th and ceased on June 11th; the first lot of birds was sold on May 28th, the last on November 1st. The total cost of eggs was £31 13*s*. 1*d*., in addition to which £4 19*s*. was expended on day-old chicks; the cost of oil for incubators and foster-mothers was £4 12*s*. 9*d*.; the cost of food was £142 4*s*. 3*d*., and £14 6*s*. 2*d*. was paid for occasional outside labour. Altogether, 2,192 chickens were sold; they were sold alive on the holding and collected by the purchasers, so that no deduction from the price has to be made for marketing or other expenses. The total sum realised was £301 5*s*. 3*d*., the average price obtained per chicken being thus 2*s*. 8¾*d*., ranging from 3*s*. in May and June to 2*s*. 6*d*. in September, October and November. The margin thus left to cover the labour of the small holder, rent, deterioration of equipment, risk, and interest on capital outlay was £103 10*s*., *plus* the value of the manure, which was regularly swept up from under the houses and around the feeding places. It must be remembered that this is the net result of not more than nine or ten months' work, and if it had been possible to commence hatching at the beginning of January, 3,000 chicks would have been reared, increasing the margin very considerably. The equipment and cost were as follows:—

	£	*s*.	*d*.
4 incubators at £6 5*s*. 0*d*.	25	0	0
14 brooders at £3 10*s*. 0*d*.	49	0	0
24 houses at £1 10*s*. 0*d*.	36	0	0
31 rolls 4-foot netting at 9*s*. 6*d*.	14	14	6
12 rolls 2-foot netting at 9*s*. 6*d*.	5	14	0
500 stakes at ½*d*.	1	0	10
Bamboo	1	0	0
Pegs	1	0	0
24 water pans at 7*d*.	0	14	0
24 grit pans at 7*d*.	0	14	0
24 feeding tins at 4*d*.	0	8	0
14 grit tins for brooders at 1*s*.	0	14	0
48 food tins at 2*d*.	0	8	0
12 food boxes at 1*s*.	0	12	0
2 barrows at 16*s*.	1	12	0
1 water barrow	1	10	0
6 tins for mixing food at 3*s*. 3*d*.	0	19	6
2 corn bins at 7*s*. 6*d*.	0	15	0
4 ,, ,, at 4*s*.	0	16	0
6 market baskets at 8*s*. 6*d*.	2	11	0
3 food baskets at 1*s*. 6*d*.	0	4	6
60 food tins at 4½*d*.	1	2	6
1 weighing machine	1	10	0
1 ,, ,,	1	0	0
Buckets, &c.	1	0	0
Kettles and sundries	0	6	0
	£150	5	10

In addition it must be remembered that considerable expense is incurred in the first three or four months for eggs and food before there is any return from the sale of chickens, so that it would be necessary to have from £50 to £100 as ready money in addition to the £150.

It may be well to indicate that the success which has attended this trial up to the present appears to be due in very great measure to the systematic attention to detail which characterised all the operations, and especially in regard to the method of artificially rearing the chickens, to the selection, purchase, preparation and distribution of the food, to the periodic tests applied to discover the actual value of the ration in increasing live-weight, and to the watchfulness exercised in preventing the possibility of the introduction or spread of disease among the stock.

An intensive form of culture such as that described above involves experience, business capacity, extremely close attention to matters of detail, and constant personal supervision.

In view of the success attending this method of chicken-rearing, the Board have made arrangements with Mr. Paynter to transfer his appliances to Cheshire, and to carry on his system during the next year as a demonstration to the small holders in that county. The Cheshire County Council have been good enough to co-operate with the Board in this matter, and have placed seven acres of land situated at Haslingden Hall, near Crewe, at their disposal for the purpose of the demonstration. It is proposed that the work should be begun immediately and carried on until October next, and it is hoped that in this way the small holders in the district will have an opportunity of seeing the system in actual work, while at the same time Mr. Paynter will be able to give them instruction and advice.

THE CONTROL OF AGRICULTURAL SEEDS IN SWITZERLAND.

JAMES LONG.

A circular letter was recently addressed by Dr. Cyril Hopkins, of the University of Illinois, to agricultural specialists in various European countries, in which he asked what relative proportion of the increase in the crops during a series of years was attributed to each of four factors: better cultivation, more skilful manuring, the increased use of foodstuffs, and seed. In reply, the Director-General of Agriculture in Holland placed the use of commercial fertilisers and improved seeds in the first position. The Director of the Royal Agricultural Experiment Station at Göttingen in Germany attributed 15 per cent. of the increase to better seed. The Principal of the Agricultural Chemical Experiment Station at Halle remarked that the greatly increased yields, especially of wheat, were dependent upon all four factors, of which good seed was one. Wagner, of Darmstadt, remarked that, while further increase by soil-enrichment has a limit, still larger returns require, among other aids, the best bred seeds of the best varieties. The Director of the Rothamsted Experiment Station attributed 10 per cent. of the increase in the crops to improved seed, while the French Minister of Agriculture gave to seed an importance equal to 15 to 20 per cent. Plant breeders and seed growers in all progressive countries have made great efforts during the past twenty years to improve all varieties of farm plants, and none more so than the Canadians and the Germans. Yet it is obvious that, however good the variety, the farmer will reap no benefit whatever from the efforts of the breeder unless the seed is pure and will germinate.

In 1881 the writer paid a first visit to the Seed Control Station at Zürich, then, as now, under the direction of Dr. Stebler. It was a surprise to find that so many samples were examined annually for English, Scottish, and Irish seedsmen. On the occasion of a third visit in July last, it was found that there is now a still larger number of seedsmen who send their samples to Zürich. The process now adopted is much in advance of that of 1881, but the results are not dissimilar. In making each test, two lots of 200 seeds each are drawn from each sample forwarded for examination, and separately tested for purity and germination. It is well known, to all who are acquainted with the characteristics of small seeds, that long experience is necessary to enable an examiner for purity to differentiate not only between the seeds of cultivated varieties of plants—and grasses may be taken as the most conspicuous example—but between the useful seeds and weed seeds. In the purity tests the sample is spread out upon a large sheet of white cartridge paper, and the examiner, with the assistance of a small instrument made of horn, draws each seed from the bulk and examines it separately. In some instances seeds are difficult to identify with certainty. Cocksfoot, for example, is placed upon a glass disc which just covers a hole in the bottom of a box which is enclosed on all sides but one, and blackened within. Beneath is a reflector which throws the sunlight upon the seed, enabling the examiner to recognise it in consequence of its reduced opacity as compared with seeds which resemble it closely in other points.

Dr. Stebler has collected and preserved for the purpose of his work seeds of a very large number of weeds, and these alone are sufficient to enable those least acquainted with the subject to realise the difficulty which exists in recognising all varieties of seeds used upon the farm. The separation of dodder seed (*Cuscuta Trifolii*) from clover seed is effected by the agitation of a series of round metal perforated trays, which are placed one above the other. The seed is placed in the tray at the top, and by constant agitation the dodder seed passes from tray to tray until it reaches the bottom free from clover seed.

A large proportion of the seeds tested for germination is placed within a germinator, which is heated to a temperature varying with the species, the season, and the hour of the day from 20° to 28° C. (68° to 82° F.). The temperature is automatically registered throughout. The seeds, all in duplicate, are placed in white saucers made of a specially selected china clay and kept in the germinator for a given length of time, and maintained at a given temperature. A card is employed for recording the data connected with each sample, and of these 11,000 are used in the year. It is thus possible, by the aid of the splendid system of recording which is followed at the Station, to refer to the details which relate to any sample of seed in a few moments. In some instances seeds such as *Poa pratensis* and *Poa trivialis* are germinated in the sunlight, each saucer being covered with a glass disc, with a hole in the centre for the admission of air.]

It is worthy of remark that seeds are sent to Zürich for examination from every important European country, as well as from the United States. In all, 171 firms of seedsmen are under special contract with the station. The number of species of seeds tested since the establishment of the station in 1876 is 149, grasses forming the largest section, and there are practically no data existing which are so valuable for reference as the figures which give the average percentage of purity and germination in each case. In the following table are shown the figures relating to some of the more important of the clovers and allied plants known in this country, tested in the year 1909–10:—

	No. of Samples.	Average per cent. of		Maximum. per cent. of		Minimum per cent. of	
		Purity.	Germin.	Purity.	Germin.	Purity.	Germin.
Red Clover...	1,625	95·9	89	99·7	98	82·3	16
White „	262	94·2	79	98·8	97	75·9	29
Alsike	190	94·9	90	99·8	99	58·4	56
Lucerne	738	96·1	86	99·6	98	83·8	68
Sainfoin	268	97·4	74	99·7	95	88·6	0
Birdsfoot Trefoil .. ... (*Lotus corniculatus*)	52	93·1	64	98·7	86	87·1	44
Trifolium incarnatum ...	14	93·7	76	97·5	96	80·1	13
Trefoil ... ... (*Medicago lupulina*)	81	96·2	67	99·8	93	88·5	24
Melilotus alba	15	88·7	51	98·6	63	56·0	42
Yellow Clover	8	88·9	77	93·1	96	84·8	56

It will be noticed that all but two of these species show an average purity of over 93 per cent., while, with the exception of Yellow Clover, no species shows a lower maximum than 97·5 per cent.—the maximum showing what is possible. When we come to germination, each species of seed is found to fall much further below the maximum than in the case of purity.

The maximum figures point to the fact that there is nothing inherent in the seeds of any variety to account for the failure to germinate, and, as we shall note presently, the average germination for the period since the establishment of the Station in 1876 until 1910 inclusive, was in most instances even smaller than for the year 1909–10. Again, although the minimum percentage of purity, if we except Alsike and Melilotus, is in most instances approximately near the average, the minimum percentage of germination was so low in almost every instance that without some form of control the purchasers of seeds of these species would often find it difficult to obtain a good sample.

The figures showing the average purity and germination of these species of seeds, as tested at the Station during a period of thirty-five years, are an excellent guide both to farmers and seedsmen, though it should not be taken for granted that an ordinary sample is of necessity first-class, if it is equally good. Although the average purity of Clovers and Trefoils is excellent, the same cannot be said in every case of their germination.

AVERAGE PURITY AND GERMINATION, 1876–1910.

	PURITY.		GERMINATION.	
	Per cent.	No. of Samples Tested.	Per cent.	No. of Samples Tested.
Red Clover	96	22,691	90	20,639
White ,,	95	3,053	82	3,258
Alsike	95	3,426	85	3,520
Lucerne	96	9,611	91	8,650
Sainfoin	97	5,432	87	6,885
Birdsfoot Trefoil	92	412	66	396
Trifolium incarnatum	95	212	88	374
Trefoil	96	871	76	1,095
Melilotus alba	93	70	65	65
Yellow Clover	86	20	69	29

The average purity of Red Clover in 1909–10 was identical with the average of thirty-five years, while the average germination was only 1 per cent. less. It will be noted, however, that there were considerable variations in the germination percentage of Lucerne, Crimson Clover, and some other species, which suggest either a bad seed-growing season or a series of inferior samples. In any case, the figures indicate the value of the averages of the longer period. It is a noteworthy fact that, although the samples of Red Clover received from England were practically equal in purity to those received from other countries, their germination percentage was the lowest in the list, viz., 82 against 94 for a much larger number received from France, and a general average of 89.

Details relating to the grasses present some instructive facts. Thirty species were examined and tested during the year 1909–10, whereas 49 species have been tested since the establishment of the station. The most popular grasses, judged by the samples examined, are, placing them in the order of the numbers submitted in the year 1909–10:—Cocksfoot (581), English Rye Grass (481), Tall Oat Grass (473), Sheep's Fescue (388), Italian Rye Grass (382), Foxtail (313), Smooth-stalked Meadow Grass (277), Meadow Fescue (275), Crested Dogstail (246), Fiorin (240), Timothy (186), Rough-stalked Meadow Grass (176), Golden Oat Grass (103), and Tall Fescue (100). Cocksfoot and Golden Oat Grass provided the most numerous samples during the period 1876–1910, viz., 13,219 and 10,391 respectively, being followed in much smaller numbers by English Rye Grass, Italian Rye Grass, Meadow Fescue, and Sheep's Fescue.

In 1909–10 the Rye Grasses, Timothy, Dogstail, Meadow Fescue, and Sweet Vernal Grass exceeded an average of 90 per cent. purity. Cocksfoot, however, only reached 74 per cent., Foxtail 68 per cent., Golden Oat Grass 67 per cent., Yorkshire Fog—which is regarded as a useful variety in Switzerland—59 per cent., and Soft Brome 50 per cent. On the other hand, Timothy alone exceeded 90 per cent. germination, the figures varying for all the most useful species from 54 per cent. for Sweet Vernal to 87 per cent. for Tall Fescue.

The variation in the samples was remarkable. The maximum of purity exceeded 90 per cent. in all the leading varieties, while the minimum, with one exception—Timothy Grass—varied from 5·5 per cent. in the case of Sheep's Fescue to 72 per cent. for Sweet Vernal, eight species falling below 20 per cent. It is, however, in connection with germination that we get the worst results. Thus, *Festuca ovina, Festuca tenufolia, Festuca rubra,* and *Poa nemoralis* gave no results in the poorest samples, Meadow Fescue gave only 1 per cent., Tall Oat Grass 2 per cent., Italian Rye Grass and Soft Brome 3 per cent., Golden Oat Grass 4 per cent., English Rye Grass 10 per cent., Sweet Vernal 12 per cent., Fiorin 17 per cent., and so on, until we reach 46 per cent. for Tall Fescue, and then 73 per cent. for Timothy, which takes the highest place for both purity and germination.

It will be well to complete this examination with a table showing the average percentage of purity and germination during the period 1876–1910 of the leading grasses used by farmers in this country. The value of the work of Dr. Stebler is practically concentrated in these figures:—

AVERAGE PURITY AND GERMINATION, 1876–1910.

	PURITY.		GERMINATION.	
	Per cent.	No. of Samples Tested.	Per cent.	No. of Samples Tested.
Tall Oat Grass	80	10,391	78	9.975
English Rye Grass	95	7,247	82	8,007
Italian ,, ,,	95	6,293	80	6,862
Cocksfoot	77	13,219	83	13,030
Timothy	98	3,749	93	3,994
Dogstail	91	3,057	77	3,392
Foxtail	75	4,090	69	4,218
Meadow Fescue	94	5,433	83	5,864
Tall ,,	85	1,151	83	1,211
Sheep's ,,	76	4,674	74	5,062
Smooth-stalked Meadow Grass	85	4,197	67	4,432
Rough ,, ,, ,,	88	1,458	76	1,508
Wood Meadow Grass	79	1,572	72	1,617
Golden Oat ,,	71	1,762	62	1,672
Fiorin	75	2,782	84	2,730
Sweet Vernal	91	710	52	808
Yorkshire Fog	69	1,296	67	1,388

There is a wide difference between the maximum purity and germination of the above species, and the averages as determined over the lengthy period of thirty-five years. Although in some instances, as in the case of Foxtail, samples of seeds are notoriously deficient in purity or germinating power, or in both, the fact remains that it is quite possible to obtain seeds of the great majority of species which are much superior to the average samples shown by the above table.

Seeds of 86 species of foreign plants, roots, grain, vegetables, and timber trees were examined and tested during the same period, but in extremely few instances was the percentage of germination high. The purity of the seed of forage crops exceeded 94 per cent. in every instance, but the germination varied from 63 per cent. for sorghum to 87 per cent. for maize. Peas, beans, and vetches were excellent from the point of view of purity, but all the species of lupins gave low returns for germination. The four leading cereals gave an average of 97·5 per cent. for purity, but only 86·5 per cent. for germination. Hemp and linseed were equal with 97·9 per cent. purity and 83 per cent. germination, while the large number of roots and vegetables, with the exception of carrots and parsnips, exceeded 90 per cent. purity, although in no instance was 90 per cent. of germination reached. Thus, carrot seed fell to 60 per cent., parsnips to 45 per cent., spinach to 63 per cent., tomatoes to 63 per cent., parsley to 56 per cent., onions to 59 per cent., leeks to 58 per cent. Among the seeds of timber trees, pine and larch were by far the most numerous, 21,800 samples of the two species being examined and tested for germination, and averaging 93 per cent. and 95 per cent. purity, but only 70 per cent. and 71 per cent. for germination. Of thirty-two species of seeds examined and tested in this section, all but four reached excellent figures for purity, but the great majority of the seeds tested germinated very badly. The lowest place is taken by the birch, with 28·9 per cent. purity and 23 per cent. germination.

PARASITIC MANGE IN HORSES, ASSES, AND MULES.

Definition.

Parasitic Mange is the name given to a condition of the skin caused by parasites, which are known as mites or acari. They belong to the family *Acaridæ*. Mange assumes the character of a contagious disease, since the parasites may be conveyed to other equine animals.

The Parasites.

The mange mites are exceedingly small, round or oval in shape, and usually only visible when magnified by the use of a hand lens or microscope. There are several distinct stages in their development; the newly-hatched mites (larvæ) have three pairs of legs, but after further development they acquire a fourth pair. The legs are furnished with bristles, claws, and sometimes with suckers. From the head project the feeding organs, and the jaws resemble saws. The body is furnished with scales, spines, and bristles. The adult females lay eggs, which hatch out into larvæ in from four to seven days. These larvæ, after successive moultings, develop into adults. The mites can exist on moist dung for several weeks, but live for a shorter time on a dry surface. The eggs are said to retain their vitality for several weeks if moisture is present, but in a dry atmosphere only for from three to six days. The mites are killed in a short period if exposed to a temperature of 104° F. or over, but moderate warmth stimulates them and renders them more active. This occurs, for instance, in warm stables and at summer temperatures.

Forms of Mange.

Three varieties of parasitic mange affect horses, asses, and mules, viz.:—(1) Sarcoptic, (2) Psoroptic, (3) Symbiotic. Each is caused by a special mite which has a somewhat different mode of life.

The *Sarcoptic* form spreads slowly, but is the most serious on account of its being the most difficult to cure. The mites, known as the *Sarcoptes*, bore their way through the outer skin, burrow underneath it, and cause irritation to the animal, setting up inflammation of the skin. In the small galleries or tunnels thus formed the mites lay their eggs. It is on account of this burrowing habit that it is difficult to reach the parasites with destructive agents. The mites may attack any part of the body, but they usually settle first about those parts which come in contact with the saddle or other harness, from which they may spread to other parts. The Sarcoptic form of mange is analogous to the itch or scabies of man.

The *Psoroptic* form generally spreads more rapidly over the body. It is more prevalent than the Sarcoptic form. At first it is usually confined to those parts situated near the long hair of the body, such as the neck, withers, rump, and base of tail, but in advanced or neglected cases the parasites may spread all over the body, and be found on the buttocks and inside the thighs. The mites, which are known as *Psoroptes*, live on the outer surface of the skin, and cling to it by means of their mouths and limbs. They bite the skin to obtain food, causing irritation and inflammation. Over the injured parts scabs are formed and scurf accumulates, amongst which the mites shelter, feed, and breed. The scab increases in size as the mites increase in number, and each new generation of young parasites selects fresh feeding ground, usually around the edge of the older scab, or the mites may, through the grooming, be disturbed and distributed, setting up additional centres of disease on other parts of the skin.

The *Symbiotic* form is probably the most prevalent, but it is not so serious as the two former. This form is usually confined to the extremities of the legs, but may also affect the tail. It develops slowly, and only exceptionally invades other parts of the body.

An animal may harbour more than one form of mange at the same time.

Symptoms.

Mange may not always be detected until it has made considerable progress, or the early symptoms may not have been regarded with importance by the owner or the attendants.

The first indications are that the animal is restless, appears to be itchy, is incessantly rubbing against any objects within reach, including the pole or shafts of the cart, or against other horses, as is frequently seen at grass. Affected animals will even bite and gnaw the parts attacked by the parasites, scratch the parts with the hind limbs if accessible, and stand rubbing one leg against the other. They may be seen or heard scraping, pawing, kicking, or stamping the feet a good deal, especially during the night in a warm stable. There may also be switching and rubbing of the tail. When the scabby parts are touched with the hand or passed over with the grooming tools, the animal will lean towards the attendant and manifest a sense of pleasure, which is frequently accompanied by a nibbling movement of the lips. The hair over the affected parts bristles or stands erect, and in more advanced cases is twisted or broken off short. Bare patches of skin are seen, due to the hair falling out or having been pulled or rubbed out. The skin may show an inflamed, pimply surface, with some long or broken hairs still in place, or the part may be quite bare and scurfy. The parasites cause pimples to appear on the skin wherever they bite. Yellowish lymph exudes from the pimples, and helps to form small scabs. This lymph may mat the scabs and hairs together into a hard mass, which may be partly or entirely rubbed off, leaving an excoriated surface. On the hairless parts red, scabby spots may be seen, which readily bleed, and there may be patches of scab containing blood adhering to the skin. In advanced, neglected, and bad cases the skin loses its elasticity, becomes dry and hard, and is wrinkled or corrugated into folds. Finally, the scabby skin may crack, forming deep fissures. These may bleed and leave nasty, unhealthy-looking sores, which in turn may fester or suppurate. There is also an offensively smelling discharge in many cases. If the disease is allowed to proceed unchecked the animal speedily loses condition, and becomes emaciated. The animal gets no rest from the incessant irritation, the appetite fails, the animal has a very dejected and repulsive appearance, becomes weaker and weaker, and may even die in a state of exhaustion.

In the Symbiotic form of mange a horse may do serious injury to its limbs, particularly to the coronet, by bruising it with the opposite foot in making attempts to relieve the itchiness.

Methods of Spread.

Parasitic Mange can only be produced by one or other of the previously mentioned mites breeding and multiplying on the animal's skin. A single fertilised egg-bearing female is sufficient to start a case of mange in an animal, and, in turn, a serious outbreak of mange in a stable containing a large number of horses. All cases of mange can be traced to contagion from an existing or pre-existing case, either near at hand or perhaps miles away. The parasites can be spread directly from one animal to another, or indirectly through the medium of litter, rugs, bandages, grooming tools, saddles, harness, mangers, stable stalls, loose boxes, stablemen and their clothing, and stable utensils. The parasites may be picked up by an animal at an hostelry, on board ship, at sales and fairs, in horse-boxes or railway trucks, at grass, by loan or exchange of harness or by the use of second-hand harness, and from shafts of carts. In fact, anything that has been in contact with a mangy animal, and which has not been subsequently disinfected, may be a vehicle of infection. Given infection, there are certain conditions which, in some animals, at least, appear to be more favourable to the development and spread of the disease; such are low condition and want of grooming. The parasites may live off the animal for some weeks in harness, clothing, litter, &c., and may therefore be capable of infecting another animal, or even re-infecting the same animal at a future date.

Treatment.

Mange is not primarily a disease, but a condition of the skin resulting from the presence and action of the parasites or mites, which obtain their nourishment by piercing the skin. The treatment must be directed to the destruction of the parasites and their eggs, and it is possible to use effective local remedies in the form of skin dressings, which will not only destroy the mites without causing further injury to the inflamed and irritated areas, but will act beneficially by allaying the irritation. The treatment is essentially an external one, but plenty of good food should be given, and if the animal's condition has been reduced or the health materially impaired, tonic medicine given internally may be indicated. Usually, however, recovery is effected without internal treatment.

Prevention.

All newly-purchased animals should be carefully examined for suspicious areas on the skin, and if such are present the animals should be isolated and kept under observation until expert advice can be obtained, but those in charge must not forget that mange caused by Sarcoptes or Psoroptes in equine animals is a notifiable disease. Care should be taken not to use second-hand or borrowed harness, clothing, grooming and stable utensils which have not been thoroughly cleansed and disinfected. Owners should be particular about the livery stables which their horses frequent, and litter which has been used for other animals should be regarded with suspicion.

In addition to the isolation and treatment of an animal actually affected with mange, particular attention must be paid to cleansing and disinfecting the stable, litter, harness, and all articles that have been used about the patient. The premises and articles to be included in the disinfection must be reckoned from a time prior to the recognition of the disease.

The Parasitic Mange Order of 1911.

Parasitic mange in horses, asses, and mules is the subject of administrative action in Great Britain, and an Order (the Parasitic Mange Order of 1911) has been issued by the Board of Agriculture and Fisheries, under the Diseases of Animals Acts, which is enforced by the Local Authority. This Order applies only to two forms of mange, viz., the Sarcoptic and the Psoroptic forms. The Order makes it compulsory for every person having in his possession or under his charge a horse, ass, or mule affected with or suspected of Parasitic Mange to give notice at once to a constable of the police force for the area wherein the animal is, and also to keep the animal, as far as practicable, separate from other equine animals not affected. In the administrative county of London (including the city of London) the notice may be given to an Inspector of the Local Authority. Every veterinary surgeon who meets with a case of Parasitic Mange in his practice is required to give notice of it to an Inspector of the Local Authority. The Local Authority is required to make the necessary examination with the assistance of a Veterinary Inspector, who, if satisfied as to the existence of disease, may serve a notice on the occupier of the premises requiring the detention and suitable treatment of the affected animal and the other animals on the premises. The Order also provides for the proper cleansing and disinfection, by the occupier, of the premises, harness, stable utensils, grooming tools, or other things used about a mangy animal. The Order makes it unlawful for any person to expose an affected animal in any market, fair, or sale-yard, or in a market lair; to send an affected animal by rail or vessel; to take such an animal along a highway without the written authority of an Inspector; or to place such an animal or allow it to stray on common or unenclosed land, or a field or other place insufficiently fenced. Any contravention of the provisions of the Order renders the person or persons concerned liable on conviction to a fine of £20.

Copies of the Order can be obtained from the Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W.

CULTIVATION OF THE TEASEL.*

EARLY in the present year a communication was received at Kew respecting the increasing difficulty of obtaining a regular supply of teasels of English growth, and asking whether it would be practicable to cultivate the plant under glass, or whether a better cultural method could be suggested than the one now practised, whereby it might be possible to grow the plant as a paying crop with more certainty than at present, and so check the serious falling off in the production of teasel heads which has occurred during late years.

Description of the Plant.—Teasels of commerce are the dry flower heads of *Dipsacus Fullonum*, L., gathered about the time when the seeds are fully grown. The plant is a well-known biennial which is widely distributed in Europe, and is included in the British Flora. During the first year of its life a tuft of bright green leaves, which may be anywhere between 6 and 15 inches long, is formed, and the following year a central stem rises to a height of from 3 to 6 feet. This branches freely, and each division is terminated with a flower head. The flowers, which open during July and August, are regularly interspersed with strong, wiry, curved bracts, which, when dry, have considerable elasticity. The uniform development of these bracts and their subsequent ripening decides the value of the heads.

A great deal of difference is noticeable in the size of the heads borne by individual plants. The central one, which terminates the main axis, is always the largest, and is sometimes called a "king teasel." The next in size are found at the ends of the principal branches and are called "queens"; whilst minor branches bear smaller heads, which are distinguished as "princes" or "buttons."

Commercial Use of the Plant.—As is well known, teasel heads have been used for many centuries by cloth-workers for raising a nap on cloth, and although inventors have tried for generations to construct a machine capable of giving the same finish, nothing has yet been found to equal the teasel. For use, the heads are arranged on a revolving cylinder, over which the newly-made cloth passes in the opposite direction to that in which the cylinder is turning. In passing, the teasel hooks tear up the surface of the cloth without in any way injuring the material, whereas steel or wire hooks often cause flaws. As a successful finish to cloth depends entirely on the regularity and evenness of the teasel hooks, it will be seen at once that damage through bad ripening, or other causes, adversely affects the monetary value of the crop. An idea of the nicety with which the heads have to be arranged for different classes of work may be gathered from the fact that one firm of teasel merchants sorts them into seventy different sizes before distributing them to its customers.

---

* *Kew Bulletin*, No. 7, 1912.

Cultivation.—The cultural methods adopted by the above-mentioned firm are as follows:—

Land is hired from farmers for the cultivation of one crop at the rate of £6 per acre per year. Ground which will produce good wheat is considered most suitable for teasels, and, when possible, a crop of wheat is followed by teasels; the ground being well worked, but not manured. Seeds are drilled into the ground in March of one year for the succeeding year's crop. In June the ground is weeded, and any vacancies which may occur in the lines made up. In July the ground is again weeded and the plants are thinned out. In October a further cleaning of the ground and loosening of the surface soil takes place. Nothing more is done until March, when the ground is again loosened. At this time the plants are finally thinned, the stronger ones being left about three feet apart each way. Those taken out are used to fill up any gaps caused by death through damp or frost during winter. In May a final cleaning is given, and during the next two months a strict watch is kept in view of a possible attack by caterpillars. The harvest takes place during August and September. When the time approaches, sheds with open sides and thatched roofs are erected in the fields, and in these the heads are dried. As the heads mature at different periods, the plants have to be gone over several times. They are cut with about six inches of stalk and tied up in handfuls. These are then threaded on long poles and hung in the sheds for about five weeks to dry. They are then taken into a barn, sorted and tied up into staves or bundles ready for sale. The bundles of heads vary considerably in price, the poorer ones being as low in price as 35*s*. and the best ones as high as £24. Some factories use about three bundles a month, and the annual value of the heads used in this country has been estimated at about £15,000.

In France the plant is found to thrive best in a light, gravelly soil, with a southern aspect. The seeds are sown in spring and the young plants well thinned out. In August they are transplanted into rows about 12 to 15 inches apart, and are kept well weeded during winter. Sometimes they are sown in the places where they are to remain, and a cereal is sown with them, so that some return may be obtained from the ground during the first year. In the following spring, as soon as the plants have attained a height of from 20 to 24 inches, a number of the side shoots are removed, from eight to twelve being considered sufficient for each plant to carry. Harvesting is commenced when the leaves begin to fall or to turn yellow. When dry the heads are packed in boxes, each containing from 25 to 100, all of which must be of uniform size and colour. In 1909, 3,690 acres of teasels were grown in the three districts of Bouches-du-Rhone, Vaucluse, and Seine-et-Oise, and 40,380 cwt. of heads were produced, which were valued at £51,237.

In America it is usual to sow the seeds in drills 3 to 3½ feet apart with a thin crop of maize. The maize is gathered and the straw left standing to afford some protection from snow during winter. The plants are eventually thinned to eight or ten inches apart in the rows, and harvesting takes place in a manner similar to that adopted in England. The average crop is 100,000 heads to the acre (about the same as in England), and the price in New York State is from 90 cents to one dollar a thousand, although it may drop to 50 cents or rise to two dollars. One thousand heads are said to weigh ten pounds.

Regarding teasel culture in England, there appear to be two critical periods. One is during winter, when many plants are killed by inclement weather, and the other is during the harvest, when a period of wet weather may partially or wholly ruin the crop. On account of this, indoor cultivation has been suggested. In support of this suggestion, a few plants have been grown indoors by the firm already referred to, and heads produced which other experts pronounced to be equal in quality to the best French heads. On the other hand, the experiment was not on a sufficiently large scale for an opinion to be formed as to the financial result. In the absence of experience, one would be inclined to consider that such a scheme would be a financial failure, for the gross average income from an acre of teasels is said to be about £70, and this after the ground has been occupied for eighteen months, including two summers. An acre of glass built in the cheapest possible way would mean a considerable outlay; the soil would require to be renewed frequently, or additional expense would have to be incurred by building portable houses; wear and tear would be a heavy item; the plants would need more cultural attention than when grown outside, and there would be a greater risk of injury by insect pests. The method of culture might, however, prove successful, but one would recommend caution and thorough work of an experimental character before an extensive scheme were undertaken.

There appears good reason to suppose that better results might be obtained by moving the cultural area from Yorkshire and the western counties to Essex and Hertfordshire, and perhaps Norfolk and Suffolk.* These counties have a drier winter and usually a sunnier summer and autumn, whilst there is plenty of suitable ground. It also seems that experiments might be conducted with a view to obtaining a race which would stand the winter well, for plants full of vigour in spring might be expected to mature earlier than those which had suffered in winter, and by advancing the harvest by one or two weeks the crop might sometimes be saved. Experiments ought also to be made with a view to saving the ground for one summer. By sowing seeds thinly on a small area of the ground, a crop of corn could be taken from the rest and the teasels planted out in autumn. What saving could be effected by this means, or whether there would be any saving, can, of course, only be determined by experiments. Efforts have been made to breed teasels yielding heads of particular sizes, but without any definite results, and the best plan seems to be to select seeds from well-grown heads, then all the sizes can be obtained from the crop.

---

* Should any farmer wish to experiment with the cultivation of teasels in the eastern counties, Mr. George F. North, of Messrs. William North & Sons, Teasel Merchants, Gelderd Road, Leeds, has expressed his willingness to supply the necessary seed free of cost.

Conclusions.—According to the present outlook, a steady demand for teasel heads is likely to continue, although it is doubtful whether there is much room for expansion in the world's production.

The cultivation of the teasel ought not to be allowed to drop in England, and experiments should be made with a view to finding the most suitable localities, the most economical method of culture, and a strain of plants which will winter well.

Farmers in the most suitable districts should be encouraged to undertake teasel-growing on a small scale, but it would be unwise for anyone to make it the sole, or even the principal crop, for although a well-gathered harvest of heads may be expected to result in good prices, so much depends on the weather at harvest time, that the crop must always be looked upon as risky.

Glass-house culture is worth a trial, but it is probable that it will be found to be too expensive to be generally adopted.

The Climatic Limits of Wheat Cultivation.

In a thesis * submitted by Mr. J. F. Unstead, and approved, for the degree of D.Sc. of London University, an attempt is made to state the present climatic requirements for wheat cultivation and to indicate somewhat broadly the limits beyond which cultivation is unlikely to extend in the more immediate future.

---

* "The Climatic Limits of Wheat Cultivation with special reference to North America," by J. F. Unstead, *Geographical Journal*, April and May, 1912. The diagram on p. 745 is reproduced by the courtesy of the editor of the *Geographical Journal.*

Heat Requirements of Wheat.—Dr. Unstead considers the poleward limits of wheat cultivation, as set by heat requirements, rather than the equatorward limits, since the latter are set by lack of moisture or by the fact that some other economic plant, *e.g.*, maize, can be cultivated and yields a higher return than wheat.

In this inquiry the total amount of heat required to bring about the full development of wheat is measured by taking into account the two factors: (1) the temperatures to which the plant is exposed; (2) the time over which these temperatures extend. A temperature of 5° C. is taken as the lower limit for the growth of wheat, and the heat requirements at any particular place are calculated by adding the number of degrees by which the mean daily temperature exceeds this minimum temperature for each day of the season between germination and ripening. Such an "accumulated temperature" is found to vary at different places and with different varieties of wheat. The following table shows the "accumulated temperatures" experienced at various stations for the variety of wheat usually cultivated in each case:—

Locality.	N. Lat.	Date of sowing.	Date of reaping.	Days of growth.	Accumulated temperature.	Mean temperature.
	°				Deg. C.	Deg. C.
Copper Centre, Alaska	62	May 10	Aug. 14	96	734	12·6
Sitka, Alaska	57	,, 3	Sept. 17	137	841	11·1
Dunvegan, Canada ...	56	April 15	Aug. 15	122	930	12·6
Vermilion ,, ...	58	May 8	,, 27	111	948	13·5
Chippewyan ,, ...	59	,, 20	Sept. 20	123	974	12·9
Nappan ,, ..	45	,, 8	Aug. 28	112	1093	14·7
South Vologda, Russia	60	March 19	,, 27	100	1100	16·0
Agassiz, Canada ...	49	April 16	,, 15	121	1120	14·3
Kostroma, Russia ...	58	May 21	,, 27	98	1135	16·6
Ufa ,, ...	58	,, 21	,, 27	102	1157	16·3
Viatka ,, ...	57	,, 22	,, 27	97	1171	17·1
Fargo, U.S.A.... ...	47	April 29	,, 8	102	1191	16·7
North Simbirsk, Russia	55	May 11	,, 17	98	1251	17·8
Indian Head, Canada...	50	April 24	,, 28	126	1293	15·3
Bozeman, U.S.A. ...	46	May 1	Sept. 3	125	1293	15·4
Brandon, Canada ...	50	April 28	Aug. 26	120	1294	15·8
Poltava, Russia ..	50	,, 12	,, 1	111	1297	16·7
Ottawa, Canada ...	45	,, 24	,, 11	108	1330	17·3
Don Territory, Russia...	49	,, 11	July 27	107	1387	18·0
South Samara ,, ...	52	May 8	Aug. 13	97	1390	19·4
Veronezh ,, ...	52	April 21	,, 6	107	1406	18·1
Bessarabia ,, ...	47	,, 12	,, 1	111	1436	18·0
North Taurida ,, ...	47	March 26	July 27	123	1469	16·9
St. Paul, U.S.A. ...	45	April 7	Aug. 7	122	1509	17·3
South Kherson, Russia	49	March 31	,, 1	123	1547	17·6

By dividing the accumulated temperatures by the number of days of growth, the mean temperatures above 5° C. are found, and by adding 5° to these results the mean temperatures above zero of the periods are obtained; these are shown in the last column of the table.

Reference to this table shows that there is no direct connection between the period of growth and the accumulated temperatures, and that it is impossible to apply the figures relating to any one station to other regions.

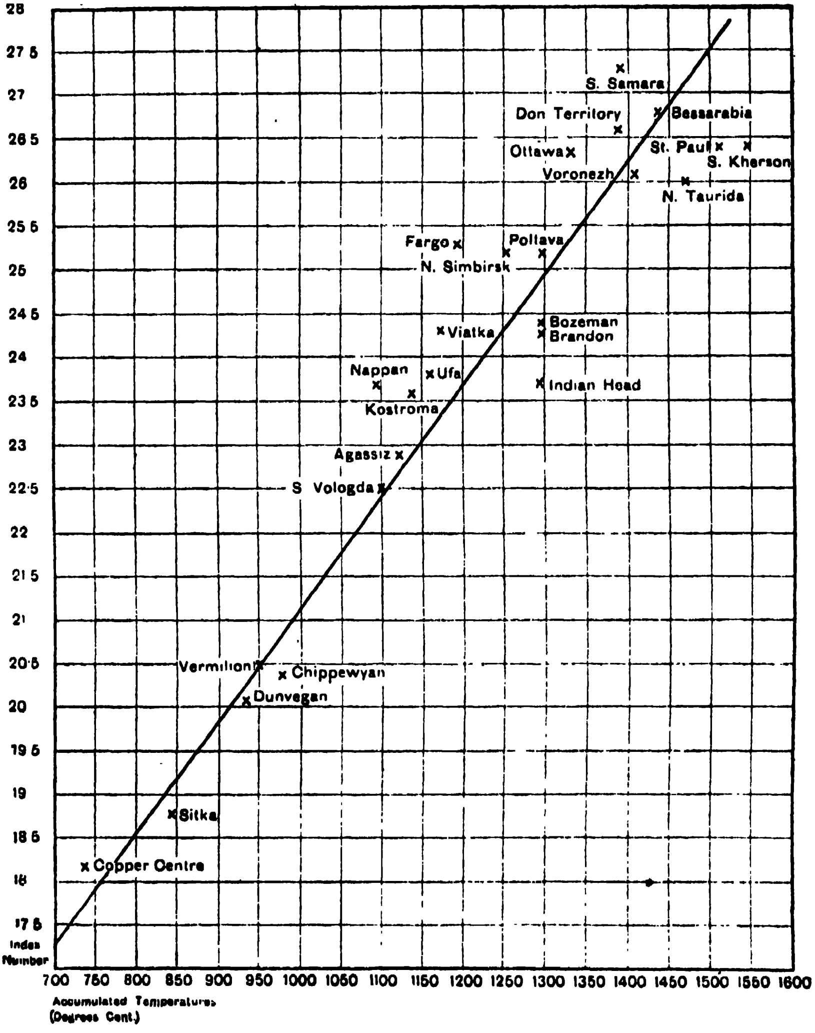
An examination of the figures in the last two columns, however, seems to show that some relationship exists between the mean temperature and the accumulated temperature, for the successively higher mean temperatures are, on the whole, associated with successively higher accumulated temperatures.

The fact that the relationship does not hold good for some of the stations suggested the influence of another factor, and, as it is generally accepted that the influence of increased periods of light very much hastens the ripening of cereals, that of light is considered.

Locality.	Accumulated temperature.	Mean temperature.	Duration of light.		Duration of darkness. Mean.	Index of mean temperature plus mean darkness.
			Total.	Mean.		
	Deg. C.	Deg. C.	hours.	hours.	hours.	
Copper Centre, Alaska	734	12·6	1,771	18·4	5·6	18·2
Sitka ,,	841	11·1	2,232	16·3	7·7	18·8
Dunvegan, Canada ...	930	12·6	2,012	16·5	7·5	20·1
Vermilion ,, ...	948	13·5	1,898	17·0	7·0	20·5
Chippewyan ,, ...	974	12·9	2,030	16·5	7·5	20·4
Nappan ,, ..	1093	14·7	1,676	15·0	9·0	23·7
South Vologda, Russia	1100	16·0	1,750	17·5	6·5	22·5
Agassiz, Canada ...	1120	14·3	1,879	15·4	8·6	22·9
Kostroma, Russia ...	1135	16·6	1,668	17·0	7·0	23·6
Ufa ,, ...	1157	16·3	1,684	16·5	7·5	23·8
Viatka ,, ...	1171	17·1	1,628	16·8	7·2	24·3
Fargo, U.S A.... ...	1191	16·7	1,566	15·4	8·6	25·3
North Simbirsk, Russia	1251	17·8	1,628	16·6	7·4	25·2
Indian Head, Canada...	1293	15·3	1,960	15·6	8·4	23·7
Bozeman, U.S.A. ...	1293	15·4	1,887	15·0	9·0	24·4
Brandon, Canada ...	1294	15·8	1,862	15·8	8·5	24·3
Poltava, Russia... ...	1297	16·7	1,726	15·5	8·5	25·2
Ottawa, Canada ...	1330	17·3	1,624	15·0	9·0	26·3
Don Territory, Russia...	1387	18·0	1,648	15·4	8·6	26·6
South Samara ,, ...	1390	19·4	1,562	16·1	7·9	27·3
Veronezh, Russia ...	1406	18·1	1,711	16·0	8·0	26·1
Bessarabia ,, ...	1436	18·0	1,669	15·2	8·8	26·8
North Taurida, Russia	1469	16·9	1,829	14·9	9·1	26·0
St. Paul, U.S.A. ...	1509	17·3	1,813	14·9	9·1	26·4
South Kherson, Russia	1547	17·6	1,868	15·2	8·8	26·4

The total duration of light during the growing period at each station is calculated on the same principle as the accumulated temperature, and from this the mean daily duration of light is obtained. These data are given in the table on p. 744.

Since from these figures it appears that a greater accumulated temperature is accompanied by a less duration of light, the mean duration of darkness is calculated, and the three factors of accumulated temperature, mean temperature and mean duration of darkness are correlated, and shown to vary in the same direction. In order to associate the mean temperature with the duration of darkness so as to show their



combined relation with the accumulated temperatures, the number expressing the degrees of mean temperature is added to that expressing the hours of mean duration of darkness, and in this way the "index number" shown in the last column of the above table (p. 744) is obtained.

The diagram on p. 745 shows graphically the relation between the accumulated temperatures and the index numbers of mean temperature *plus* mean duration of darkness during the periods of growth. Dr. Unstead argues from this diagram that the factors of mean temperature and mean duration of light are very closely correlated with the accumulated temperatures.

If the above diagram is accepted as trustworthy, it is possible with its aid, and given the necessary data for any place, to determine whether wheat can be grown there; *e.g.*, it has been shown by experiments that sowing can take place in spring when the temperature rises above 5° C., and that reaping must take place in autumn before the temperature falls to 10° C. The accumulated temperature above 5° C. between these two dates can be calculated, and the "index number" of mean temperature and mean duration of darkness during the period found. If, now, the accumulated temperature found by the aid of the diagram to correspond to the index number is less than the accumulated temperature actually recorded, the probability is that wheat cultivation is possible, while if it is above this figure the probability is that wheat cultivation will not be possible. Thus, taking the case of Sitka, the accumulated temperature actually experienced during the period between sowing and ripening is 830°, the mean temperature is 10·4°, the mean duration of light is 16·2 hours, and the index number of mean temperature *plus* mean darkness is therefore $10{\cdot}4 + (24 - 16{\cdot}2) = 18{\cdot}2$. With this index number the straight line in the figure indicates a required accumulated temperature of 770°. Consequently the actually accumulated temperature exceeds this by 60°, and wheat cultivation is possible.

This method was found to hold good in all cases tested by Dr. Unstead, and in no case was there a conflict between this theory and the ascertained facts of cultivation.

Rainfall Requirements of Wheat.—Dr. Unstead considers two types of wheat-growing country: (1) that with a relatively mild winter with rain in the cooler parts of the year, where the grain is sown either in autumn or spring, and ripens before the hottest parts of the summer; and (2) that with a more extreme climate with rain during the hotter part of the year, where the grain may perhaps be sown in the autumn, but is more commonly sown in spring, and in either case grows during the spring and summer, ripening at almost the hottest part of the year.

The first or "Mediterranean" type of climate obtains in California, Russian Turkestan and parts of Victoria, Australia, and from a consideration of the conditions under which wheat is grown in these districts it is concluded that in regions of the "Mediterranean" type a mean annual rainfall of ten inches is adequate for wheat cultivation; and where specially favourable circumstances obtain, such as lower temperatures or a very suitable soil, this amount may be reduced by one or even two inches.

The estimate of the rainfall needed in districts of the second or "Continental" type was obtained from a consideration of the conditions in the Great Plains of N. America and in S.E. Russia. Allowing for the cultivation of drought-resistant varieties, such as "Durum," and for the fact that soil moisture can be effectively conserved by dry farming and summer fallowing, the conclusion is reached that a mean annual rainfall of eleven inches will be adequate for the cultivation of wheat over the northern part of the Great Plains of the United States. Consequently, it is probable that a greater mean amount would be required in the more southerly portions, but of this no numerical estimate could be made from the data obtainable; somewhat less than eleven inches would probably be adequate in the Canadian part of the area.

As there is no record of any stations in southern Canada receiving a mean annual precipitation of less than eleven inches, it follows that the whole of the Great Plains area within the Dominion (including the whole of the semi-arid region of southern Alberta and Saskatchewan) is capable of wheat cultivation (the heat requirements of the area were shown to be fulfilled), provided that suitable methods of cultivation are adopted, including summer fallowing and the use of drought-resistant varieties, and that the districts having sufficient heat will not be affected by any considerations as to rainfall.

With regard to the United States, it is concluded that wheat cultivation may extend throughout the whole of North Dakota and South Dakota, and across Montana as far as the Rocky Mountains, except where it is impossible to obtain small additional supplies of water from streams or from underground sources (for domestic purposes, for stock, and for growing fruit and vegetables for the farmer's own use), or where the soils are exceptionally unsuitable. It is not improbable, in addition, that wheat may be cultivated throughout the whole of the State of Nebraska.

Conclusions.—These considerations as to the control of wheat cultivation by temperatures and rainfall tend to show that an enormous extension of the wheat area may occur; but it is impossible to express this in a numerical form, for there are not sufficient data regarding the probable proportion of these new lands which will be actually productive. Within the regions possessing sufficient heat and rainfall, certain areas will doubtless be found unsuitable for cultivation, other areas will be retained for pastoral purposes, and the arable land will be in part devoted to other crops. It is therefore impossible to estimate the ultimate total production of wheat.

With regard to wheat production in North America, two facts, however, are clear: first, that the total acreage will be very much greater than it is at present, since it may be extended into the colder regions in Canada, and into the drier regions both in Canada and in the United States; second, that the yield per acre on the lands at present cultivated will increase as a result of scientific investigation and its application by farmers. Although the yield on the semi-arid lands is likely to be less than on the better-watered lands, even this lower yield may exceed the average yield of the present time. Hence a production double that of the present is quite possible as far as the physical conditions are concerned.

The greatest harvest until 1911 was in 1909, when over 900 million bushels were obtained in North America, of which nearly one-fifth was reaped in Canada; it is, therefore, quite possible that nearly 2,000 million bushels may be produced in the future, and the proportion coming from Canada may be not much less than that coming from the United States.

Whether the economic factors will make such a production profitable, and therefore commercially possible, will depend not only upon the future conditions of production in North America itself, but also upon the future conditions of demand and supply of this commodity in the other great wheat-producing and wheat-consuming regions of the world.

The Cultivation of Pansies and Violas by Allotment Holders.

In the neighbourhood of Hounslow (Middlesex), and perhaps more especially at Hatton, a little hamlet north of Feltham, the cottagers and allotment holders supplement their income by growing pansies and violas for what might be called the suburban gardener's trade. Nearly all the cottages have their strip of garden at this time of year covered by either pansies, or violas, or both, while in some allotments which cover an area of 15 acres, most of the plots are devoted to growing the same plants. Not far away another 5 acres of allotments are similarly cropped.

During the summer these plots and gardens, which are from 15 to 20 rods in extent, grow the ordinary garden crops —potatoes, beans, peas, &c.—and, when the occupier can obtain it, they are manured with farmyard dung. The seed is usually saved by the grower from the previous season, and is sown about the first week in August in a small plot, if possible with a northerly aspect. When the resulting seedlings are sufficiently large to handle, they are transplanted to the garden or allotment, which by this time has been cleared of its summer crop and dug over. Having been planted out 4 inches apart each way, they are left for the winter. This year, owing to the mild weather, many are already in bloom. Their normal time of blooming is March or April, according to the season, and when suburban residents start gardening operations, hawkers make their way to Hounslow and Hatton with hand and donkey carts, and buy up the pansies and violas. The plants are sold in boxes usually containing two dozen, and the average price per box is 6*d.*, but in some seasons, *e.g.*, 1911, the price is only 2*d.* per doz. By carrying them into the western and south-western suburbs, the hawkers are enabled to retail them at about one penny each, but some of the plants with finer blooms are readily sold for 1½*d.* and 2*d.* each. It is necessary that the plants should have commenced blooming, for the amateur gardener likes to see what he is buying. At the rate of 3*d.* per dozen it is possible for a man to make £7 or £8 profit from his crop on a small allotment. In the case of a garden, his takings are mostly profit, since he pays no extra rent and does the necessary cultural operations himself in his spare time. Although it by no means follows that a man with an acre of land would make a proportional profit, it affords an example of what a man can do with a small piece of land by specialising in one particular plant for which he has a good market close at hand. In this case there are no outgoings for labour, little or no rent, for the allotments are cheaply let, and no railway expenses or salesman's commission, the wife being able to sell the plants while her husband is at his ordinary work.

Percentage of Curd in Imported Butter.

In the course of proceedings taken by the Board of Agriculture and Fisheries in two cases under the Butter and Margarine Act, 1907, it was alleged by the defence that imported butter frequently contains a quantity of curd in excess of 2 per cent. The information in the possession of the Government chemist did not support this contention, but it was considered desirable that an extended and systematic examination of imported butter should be carried out with the view of ascertaining the limits of curd in butter consigned to this country.

A determination was therefore made at the Government Laboratory of the curd in all the samples of imported butter taken by officers of the Board of Customs and Excise under the Sale of Food and Drugs Acts from the 14th May to the 5th October, 1912. There was no selection of samples, and practically every class of butter imported into the country was represented amongst the samples examined.

Three hundred and sixty-six samples in all were analysed, and in no case was the curd found to amount to as much as 2 per cent. The range varied from a minimum of 0·40 per cent. to a maximum of 1·86 per cent., with an average percentage of 1·04. There were only eleven samples in which the curd exceeded 1·5 per cent., and of these six contained between 1·5 and 1·6 per cent., four contained between 1·6 and 1·7 per cent., and one contained 1·86 per cent. A summary of the results is given in the following table:—

Summary of the results relating to the curdy matter in 366 samples of butter.

Country of Origin.	No. of Butters.	Range of Curd.		Average Percentage of Curd.
		Lowest.	Highest.	
Russia and Siberia ...	102	0·43	1·64	1·08
Australia	32	0·54	1·34	0·82
New Zealand.	27	0·48	1·36	0·77
Denmark	20	0·78	1·51	1·14
Udenlandsk butters from Denmark	41	0·61	1·48	1·10
France	41	0·44	1·86	1·11
Germany	5	1·03	1·39	1·18
Channel Islands	1	1·31	1·31	1·31
Belgium	6	1·04	1·38	1·15
Holland...	62	0·74	1·53	1·11
Sweden	21	0·81	1·46	1·11
Argentina	8	0·40	0·94	0·64
Average		0·40	1·86	1·04

Absorption of Copper Fungicides by Potatoes.

IN connection with experiments on Wart Disease of potatoes conducted in Lancashire in 1910, different plots were treated with Strawsonite and copper sulphate, each at the rate of 75 lb. per acre. The materials, in the form of a powder, were applied to the plots at the time the potatoes were planted, and as it seemed possible that some of the copper might be absorbed by the crop, samples of the tubers from each plot, and also from an adjoining piece of ground left untreated, were analysed at the Government Laboratory. The tubers selected for examination were thoroughly washed and scrubbed to remove all earthy matter, and were then peeled as for culinary purposes, all eyes and bruises being removed and included in the peel. The peel and the potato substance were examined separately for copper.

The amounts of copper found in the peel and in the substance of the tubers respectively are shown in the following table:—

	"Strawsonite Plot."		"Copper Sulphate Plot."		"Untreated Plot."	
	Peel.	Substance.	Peel.	Substance.	Peel.	Substance.
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Grains of copper per lb. of undried material ...	0·217	0·021	0·028	0·014	0·021	0·014
Grains of copper per lb. of dried material ...	1·44	0·10	0·16	0 08	0·12	0·07

The figures show that the quantity of copper was somewhat greater in the peel than in the potato substance. There was practically no difference between the quantity in the tubers on the copper sulphate plot and that in the tubers on the untreated plot. The most noteworthy feature was the quantity of copper in the peel of the tubers from the plot treated with Strawsonite.

In order to check this somewhat striking result, small plots treated similarly to those previously described were planted at Kew in 1912, and samples of the crop of tubers from the different plots were examined at the Government Laboratory. The results are shown in the following table:—

	"Strawsonite Plot."		"Copper Sulphate Plot."	
	Peel.	Substance.	Peel.	Substance.
	Grains.	Grains.	Grains.	Grains.
Grains of copper per lb. of undried material ...	0·0144	0·0084	0·0168	0·0098
Grains of copper per lb. of dried material ...	0·08	0·045	0·094	0·051

In this case the tubers from the Strawsonite plot contained similar amounts of copper to those from the copper sulphate plot; and the results obtained two years ago are therefore not confirmed. A comparison of the results obtained in the two years shows that the samples examined in 1912 did not contain more copper than was found to be present in 1910 in tubers which had been grown in soil untreated with copper fungicides.

Control of the Hop Flea-Beetle.

NOTES on two species of Hop Flea-Beetle were given in this *Journal* in October, 1909, pp. 559–62. Considerable damage may sometimes be done by these tiny beetles. A hop flea-beetle which is a serious pest in British Columbia,* is known as *Psylliodes punctulata* Melsh., and is closely related to the species described in this *Journal*, as noted above. Its life-history, however, is somewhat different, the eggs being deposited in the soil and the larvæ feeding on the delicate rootlets of the hops and weeds. The beetles alone appear to attack the foliage, tender buds and stems of the hops, but they also feed on many other plants, *e.g.*, mangolds, tomatoes, nettles, radishes, goosefoot, dock, and sheep's sorrel. Later in the season they reach the hop cones, of which they are very fond. At the places of experiment and observation there are two distinct broods of the beetle, the adults of the second generation passing the winter in shelter—places above-ground and in the soil.

In the early part of the season, when the hop shoots are reaching out to the strings, the beetles may be caught by the use of tarred boards or sticky shields. These may be placed on the leeward side of the vines, and the beetles jarred or thrown on to them by a single sweep of a large brush of evergreen or a feather duster. In experiments conducted in the United States, it was found that by using a single board in this manner 85 per cent. of the beetles could be captured. The "tarred boards" may be made simply and light to handle by stretching 8-ounce canvas over a wooden frame 4 ft. long by 3 ft. wide, coating the canvas with tar, and attaching a handle, or by tacking a piece of light galvanised iron, 3 ft. long by 2 ft. wide, round a curved board to keep it in shape.

When the vines are trained it is found that the beetles may be readily controlled by the use of "tanglefoot" bands, or sticky bands placed round the stems 2 ft. from the ground, adjacent leaves being removed to prevent them being used by the beetles as bridges, the insects crawling up the stems and not flying or jumping on to the vines. In the experiments mentioned it was found that, two weeks after the application of sticky bands, leaves above the bands were untouched by the beetles, while those below were completely riddled. The trellis poles should also be banded. It is stated that "These tanglefoot bands form a perfect barrier to the insects. Even though the beetles are present in very large numbers they cannot reach the upper parts of the hop vines, which can therefore produce a crop without molestation." If the banding is thoroughly done and the gardens are kept clean during the growing season, all suckers being cut away, the beetles are starved; very few beetles will live through the winter to attack the vines in the following spring.

---

* The Life History and Control of the Hop Flea-Beetle: *U.S. Dept. Agric., Bur. Entom.*, Bull. No. 82, Part IV.

The Agricultural Output of Ireland in 1908.

AN inquiry into the agricultural output of Ireland, similar to that made in Great Britain by the Board of Agriculture and Fisheries, was carried out under the Census of Production Act, 1906, by the Irish Department of Agriculture and Technical Instruction, and a report has recently been published.*

It is explained in the Report that Irish agricultural produce is disposed of in the following manner:—

(1) Consumed as food by people in Ireland or used as raw material in Irish industries other than agriculture.

(2) Consumed by live-stock in Ireland belonging to non-agriculturists (*e.g.*, by horses in towns);

(3) Exported from Ireland;

(4) Used for further agricultural production in Ireland (*e.g.*, crops fed to live-stock on farms or used as seed, milk fed to calves and pigs);

and accordingly the "Output of Agriculture in Ireland" has been taken to mean the sum of (1), (2) and (3). The crops, &c., represented by (4) must be considered raw material used in the production of (1), (2) and (3).

The value of the total output of agriculture in Ireland in 1908, as so explained, is estimated at £45,574,000. Of this total output £23,977,000 was exported from Ireland and £21,597,000 was consumed in Ireland. The total value of the crops produced in Ireland is estimated at £30,926,000

---

* *Department of Agriculture and Technical Instruction for Ireland*, The Agricultural Output of Ireland. Wyman & Sons. Price, 2*d.*

(exclusive of the value of the grazing); crops worth £24,409,000 were, however, used for further agricultural production, leaving only £6,517,000 to be reckoned as the "output" from this source. The total value of live-stock and live-stock products is estimated at £40,050,000; products valued at £993,000 were, however, used for further agricultural production, leaving £39,057,000 to be taken as the output from the live-stock of the country. It appears that 79 per cent. of the value of the total crop production was used for further agricultural production in Ireland, 18 per cent. was consumed otherwise in Ireland, and only 3 per cent. was exported. The live-stock industry presents a marked contrast, as only 2 per cent. of the value of the output from this source was used for further agricultural production, 40 per cent. was consumed in Ireland, and as much as 58 per cent. was exported.

The value of the crops produced in Ireland and used as seed in Ireland is estimated at £2,067,000, and the value of the crops produced in Ireland and fed to live-stock in Ireland at £22,342,000, the two making up the total of £24,409,000 used for further agricultural production. Of the crops valued at £5,565,000 consumed in Ireland the value of the quantity consumed by the population of Ireland is estimated to have amounted to £2,435,000 (£1,643,000 by the rural population, and £792,000 by the town population). The value of that portion consumed by horses in towns is estimated at £1,408,000, and the remainder (including malting barley, flax, timber, &c.), which was used as raw materials for industries in Ireland, is estimated at £1,722,000.

The value of the milk fed to calves and pigs is estimated to have been £993,000, and this was the only part of the £40,050,000 (which represents the total output from the live-stock industry) that was used for further agricultural production. Of the live-stock and live-stock products valued at £16,032,000 consumed in Ireland, products valued at £8,682,000 were consumed by the rural population, £3,168,000 by residents in Irish towns, and the remainder, valued at £4,182,000, was used as raw material, &c., in Irish industries. The latter item includes pork valued at £3,975,000, used by bacon-curers in Ireland.

Crop Production.—The estimated values of the principal crops produced in Ireland in 1908 were as follows:—

	£
Hay	10,230,000
Oats (Grain, Screenings and Straw)	7,544,000
Potatoes	6,056,000
Turnips	2,596,000
Barley (Grain, Screenings and Straw)	1,293,000
Mangolds and Beet	909,000
Grass Seed	421,000
Wheat (Grain, Screenings and Straw)	404,000
Flax and Tow	404,000
Fruit	360,000
Other Crops	709,000
Total value of Crops	£30,926,000

Capital Value of Live-Stock.—The total value of the live-stock in Ireland on the 1st June, 1908, was estimated at £65,753,000, the estimated values of the principal classes of live-stock being:—

	£
Cattle	44,027,000
Horses	11,335,000
Sheep	5,613,000
Pigs	2,611,000
Poultry	1,570,000
Other Live Stock	597,000

Production of Live-Stock and Live-Stock Products.—The following are the values of the principal items in the output from live-stock:—

	£
Cattle	14,041,000
Butter	6,704,000
Pigs	5,868,000
Eggs	4,130,000
Milk (consumed as such)	3,905,000
Sheep	2,206,000
Horses	1,464,000
Poultry	1,160,000
Wool	429,000
Other Products	143,000
Total	£40,050,000

The following table shows a comparison between the value

	Estimated Capital Value.	Estimated Value of Production.
	£	£
Cattle	44,027,000	24,762,000
Horses	11,335 000	1,468,000
Sheep	5,613,000	2,635,000
Pigs	2,611,000	5,868,000
Poultry	1,570,000	5,290,000
Other Stock	597,000	27,000
Total	65,753,000	40,050,000

of the production in 1908 from each description of live-stock and the capital value of that stock on the 1st June, 1908. The output value placed opposite cattle includes the value of the derived products—butter, milk, cream, cheese, and cattle hides. Similarly, the value opposite sheep includes the value of wool, and opposite poultry the value of eggs.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Sickness in Glasshouse Soils (*Journal of Agricultural Science, October, 1912; Dr. E. J. Russell and Mr. F. R. Petherbridge*).—It has long been known that soils undergo a change under the intense system of culture prevalent in glasshouses, and gradually become unfitted for the continued growth of a crop. This deterioration—technically known as "sickness"—is perhaps best seen in commercial cucumber houses, where it may be so marked as to necessitate the soil being thrown away after a single season's use. "Sickness" also occurs in tomato houses, but under the less intensive system practised it sets in more slowly, and the soil may last four or five years.

The investigations described in this paper showed that the "sickness" occurring in glasshouse soils was due to (1) a falling off in bacterial activity in the soil; (2) an accumulation of parasites and disease organisms directly attacking the crop grown. No indication was found that the soils examined contained any substance toxic to either plants or bacteria; they were well supplied with plant food and with calcium carbonate. On the other hand, the factor responsible for the decreased bacterial activity resembled in every way that already shown to exist in ordinary arable soil, and suggested by Russell and Hutchinson (see *Journal*, March, 1910, p. 1032) to be protozoa.

Partial sterilisation was found to be effective in dealing with sick soils, thus confirming the practice of some large growers who have been in the habit of steaming their old cucumber soils or of treating them with antiseptics. Trials were carried out to ascertain the most effective and practicable system of sterilisation on a large scale. Of the methods tried, exposure to a temperature of from 96° C. to 98° C. for two hours proved the most effective, as it not only killed destructive and parasitic organisms, but also effected a certain amount of decomposition of the plant food in the soil, and brought about a great development of fibrous roots. This treatment is practicable on a large scale (see *Journal*, January, 1912, pp. 809–826). Toluene and carbon disulphide produced satisfactory improvement in the numbers of bacteria and the rate of formation of plant food, but they did not kill all the disease organisms, nor bring about the useful secondary changes, and for practical purposes steaming was found to be the best of all the methods tried.

---

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

FIELD CROPS.

Varieties of Wheat (*Dept. of Agric. and Tech. Instr. for Ireland, Wheat Experiments at the Albert Agric. Coll., Glasnevin,* 1911–12).—The tests with varieties of wheat carried out in 1911 were repeated in 1912, and four additional varieties were included. Three of these were Danish wheats, imported by the Department from Copenhagen, and one a variety grown to some extent as a spring wheat in counties Carlow and Kildare.

The yields for 1912 were with one exception considerably lower than those for 1911. All the French wheats show a large decrease, and the only increased yield for the whole series is that of Red Fife, the seed of which was obtained from the produce of some hand-selected ears grown by the Department in 1910.

The three Danish wheats—Queen Wilhelmina, Tystofte Small Wheat, and Danish Square Head, gave very good yields. In point of quality Red Fife was undoubtedly the best wheat of the series, next in order coming Burgoyne's Fife. Queen Wilhelmina, a white wheat, may be placed next, and then, a long way behind, White Marvel. Tystofte Small Wheat and Danish Square Head are varieties of the Square Head Master type, but not so coarse. The French varieties, with the exception of White Marvel, are very poor quality, Dreadnought and Perfection being wholly unsuited for milling requirements. The partial failure of Perfection this year was in large measure due to bad germination of the seed.

April Red, a variety resembling Red Fife in shape of ear, excepting that it has a distinct awn, is a late spring wheat. In yield it does not equal Red Fife, to which variety it is also inferior in quality. Regarding the two new hybrid wheats, Little Joss and Burgoyne's Fife, the former is undoubtedly the heavier yielder, but in quality it is greatly inferior to Burgoyne's Fife. Other things, such as quality of straw, being equal, there is nothing to recommend Little Joss in preference to Tystofte Small Wheat, a variety which by reason of its productivity and generally acceptable quality, is grown extensively in Denmark.

Of all the varieties tested, Queen Wilhelmina, on account of its yielding capacity and quality, appears at present to be the most desirable wheat, and certainly merits the attention of wheat-growers.

Varieties of Winter Wheat (*East Anglian Institute of Agriculture, Chelmsford; Mr. A. Malins Smith and Mr. R. M. Wilson*).—Half-acre plots of seven varieties of wheat, viz., Wilhelmina, Browick, Little Joss, Sensation, Square Head Master, Carter's White Stand-up, and Garton's Victor, were grown at two centres in Essex in 1911–12. In addition, the first four varieties were tested on two other farms. The results, being based on one year's trial only, are regarded as being merely rough indications of the yielding capacities of the wheats, but so far as definite conclusions could be drawn, the results showed that Little Joss, Wilhelmina, and Victor are heavy yielding wheats, and there appeared to be little difference in cropping capacity between them. Sensation appeared to be a poor yielder. White Stand-up varied very much; at one centre on very heavy clay soil it gave the heaviest crop, on a lighter soil it proved unsatisfactory. With regard to quality, Wilhelmina and Victor are regarded as being of low quality, but Little Joss as being of a good average standard, similar, in fact, to Square Head Master, from which it was bred.

Manuring of Swedes and Turnips (*West of Scotland Agric. Coll., Bull.* 60; *Mr. J. Wyllie*).—Experiments were carried out in the three years 1909, 1910, and 1911 on forty-five farms in the central and south-western counties of Scotland. Previous experiments had shown that to meet the requirements of the turnip crop for phosphate, a suitable plan was to give half in the form of superphosphate and half in the form of basic slag. In the trials under notice, therefore, all the manured plots received similar amounts of such a dressing of phosphatic manure, and attention was devoted to comparing different forms of potash and nitrogenous manures, and to ascertaining the effect of applying them in various ways.

An examination of the results at the different farms shows that there was a striking lack of consistency in the effects of any particular dressing, and it is concluded that the average results are only of value as a moderately safe guide to a farmer who is not prepared to conduct experiments for himself to find out the requirements of his own particular soil. Subject to this reservation the following general conclusions are drawn :—

(1) Where farmyard manure is not applied, the use of both potassic and nitrogenous manures for turnips is to be recommended, but of the two the former are more essential and more likely to yield high money returns.

(2) Kainit and potash manure salts are about equally efficacious for the turnip crop.

(3) The best nitrogenous dressing for turnips varies very much according to local conditions, and without a knowledge of these it is impossible to give any useful opinion on the subject.

(4) Contrary to popular opinion, both nitrate of soda and nitrate of lime applied in the drills give in the majority of cases better results than equal quantities given as a top-dressing.

Manuring of Runner Beans (*Leicester Educ. Comm., Desford Industrial School; Mr. Wm. Stewart*).—Plots, each one-eighth of an acre in extent, were laid out on strong clay soil, which has carried garden crops for the past thirty years. The season of 1912 was unfavourable, the heavy rain (7·01 in. were recorded), and the low temperature of August being detrimental to the setting of the fruit. The plot receiving farmyard manure and sulphate of ammonia at the rate of 16 tons and 1 cwt. per acre respectively, gave the best results, being followed by the plots receiving farmyard manure *plus* nitrate of soda, and farmyard manure *plus* superphosphate. Neither farmyard manure nor artificial, when employed alone, gave such satisfactory results as when both were used.

Varieties of Clover (*Bull. Bur. Agric. Int. and Pl. Dis., July,* 1912).—Experiments were carried out by the Danish Agricultural Society at six stations in Denmark from 1877 to 1896, and from 1900–1906 with regard to the yield of hay from several varieties of clover, the seed of each variety being obtained from several sources.

The yield of hay from Alsike (*Trifolium hybridum*) was greatest in the case of Swedish seed, which gave an average two years' crop of

53½ cwt. per acre. Seed from England and the Rhine provinces of Germany was only slightly inferior in the years when it was tried; that from the United States and Canada was not so good.

The largest yield of White Clover (two-year crop of 42½ cwt. per acre) was from Danish seed. Russian seed produced an early crop, but the yield was from 1½ to 3 cwt. per acre less than that from Danish seed. German and Austrian seed produced an average two-year crop of about 7 cwt. less than that from Danish seed. Dutch, English, and American White Clovers were not very successful, and seem to be of little importance on the Danish market. Italian White Clover ("Lodi") was late; it has very large leaves, and was more luxuriant and productive than any other type, but the crop was not always certain.

Trefoil seed from Belgium and Western Germany gave a yield of about 3 to 3½ cwt. of hay per acre less than French seed.

Seeds of an annual variety of White Clover from Hungary, Italy, and Silesia were failures.

DAIRYING.

Factors affecting the Richness of Cream obtained from Separators (*Univ. of Missouri, Agric. Expt. Sta., Bull.* 94).—On a farm the percentage of fat in the cream obtained varies considerably from day to day. For this variation it was believed that difference in details of separating were responsible, and investigations were conducted with a view to determining the effect of various factors on the richness of the cream obtained. It was found that:—(1) An increase of *speed* results in a larger proportion of skim milk and a higher percentage of fat in the cream, and within ordinary limits the higher the speed the less the amount of fat remaining in the skim milk. A reduction of speed causes a poorer quality of cream to be produced, and fat is lost in the skim milk. (2) Contrary to general belief, a reduction in the temperature of the milk causes a higher proportion of skim milk and a small amount of cream, with a higher percentage of fat. The effect is much more pronounced when the separator is adjusted to deliver cream with a high fat content. (3) The amount of fat in cream varies in direct proportion to the composition of the milk. The ratio of cream to skim milk is not affected by a variation in the richness of the milk separated. (4) The rate of inflow of milk affects the ratio of cream to skim milk, but the difference does not all fall on the cream outflow. A reduction in inflow reduces both the cream and the skim milk, but the former somewhat more in proportion to the latter. A smaller inflow, therefore, increases the percentage of fat in the cream to a certain extent.

Milk Tests and Records (*Lancashire C.C. Educ. Com., Farmers' Bull. No.* 23; *Dr. T. Milburn and Mr. R. Richardson*).—A series of tests and records with various herds in different parts of Lancashire was started four years ago to demonstrate the advantages accruing from the keeping of exact records of the milk production of each cow in a herd. Observations on the results of the four years' work may be summarised as follows:—

(1) In average herds the amount of variation in milk production is very great. Comparing animals of the same age which calved at

the same time of the year, the produce from the best cows was in many cases worth twice as much as that from the worst.

(2) Except in one case, there has been an improvement in the milk yields of the herds in the period during which they have been under test. The average increase in the period 1908–1910 was 47 gallons per cow. At the same time there has been an improvement in the quality of the milk, both as regards fat, and solids-not-fat.

(3) The milk of cows giving a small yield is not necessarily richer in fat or in solids-not-fat than that of cows giving a large yield; in fact, the opposite may be the case.

It is concluded that by keeping records, coupled with careful breeding and selection, the general standard of dairy herds in the county could be much improved, especially as regards the yield of milk.

Incidentally it was found that in cases where milking took place early in the afternoon, the morning's milk frequently contained less than 3 per cent. of fat.

Yield of Cheese and Losses in Pressing and Ripening (*Dairying and Dairy-Farming—Dairy Students' Union; W. Speaight and Sons, 98 and 99 Fetter Lane, E.C.; price 5s.*).—Records were kept at the County Dairy School, Chelmsford, of the yield of cheese from milk obtained from six local farms in 1911. At the same time, the loss in weight during pressing and ripening was observed. The cheese made was Cheddar, and the average results obtained per 100 gallons of milk in each month were as follows:—

Month.	Weight of Cheese.	Loss in Press.	Loss in Ripening.	Total Loss.
January	108·6 lb.	13·4 lb.	7·7 lb.	21·1 lb.
February	109·7	15·5	9·2	24·7
March	112·1	10·4	5·6	16·0
April	111·8	12·7	6·2	18·9
May	101·4	7·7	5·2	12·9
June	94·8	13·2	8·3	21·6
July...	100·2	11·0	7·0	18·0
August		No cheese made		
September	102·3	13·8	6·4	20·2
October	108·0	11·5	6 8	18·3
November	113·6	8·0	9 6	17·6
December	113·6	7·9	6·9	14·8
Averages for the year	106·9	10·4	7·1	18·6

The cheeses when taken from the press were placed for two months in a ripening-room kept at a temperature of 55°–60° F. Afterwards they were removed to a cool store. It was found that the shrinkage in the latter was so small as to be hardly noticeable.

Helianthi as a Food for Dairy Cows.—A note on the value of Helianthi as a food for stock was given in this *Journal* for February, 1912, p. 937. The following information, more especially with regard to its value as a milk-producing food, is taken from the *Annales de l'École Nationale d'Agriculture de Grignon* (France), 1910.

As a result of reports as to the surprisingly beneficial effect of both stems and tubers on milk production, an experiment was carried out by the school at Grignon, principally with a view to comparing the value of Helianthi with hay for milk production.

The milk yield and the fat content diminished as a result of replacing hay in the ration by an equal weight of Helianthi fodder or by more than twice the weight of tubers. No difficulty was experienced in getting the cow to eat the fodder, but the tubers were consumed much less readily.

An experiment is cited in which the yield per acre obtained was 13 tons of stems and 10½ tons of tubers. The composition of the stems, leaves, and tubers was as follows:—

	Stems. Per cent.	Leaves. Per cent.	Tubers. Per cent.
Water	75·60	76·70	72·48
Protein	3·10	3·50	5·31
Fat	0·13	0·66	0·48
Carbohydrates (including sugar)	16·33	14·32	18·65
Fibre	3·61	1·67	1·32
Ash	1·23	3·15	1·76

WEEDS AND PLANT PESTS.

The Germinating Capacity of Seeds of Dodder (*Die landw. Versuchs-Stationen,* Band LXXVII., Heft I. u. II.).—It is concluded from numerous experiments with seeds of dodder that—

(1) Seeds of *Cuscuta suaveolens* have a higher germinating capacity than those of common dodder (*Cuscuta Trifolii*); on an average, after 28 months 67·6 per cent. of the former germinated as compared with 47 per cent. of the latter.

(2) In both varieties germination is very protracted; the largest percentage germinates in the month following sowing, but small quantities continue to germinate through many succeeding months, these quantities gradually decreasing. The dodder seeds, once sown with those of a crop, are thus a continual source of danger.

(3) In the case of *C. Trifolii,* 6 per cent. of the seeds which had not germinated after 27 months, and in the case of *C. suaveolens* 12·5 per cent. of the seeds which had not germinated after 28 months were alive, and these "hard" seeds constitute a source of danger for several years.

Physiological and Fungicidal Effect of Bordeaux Mixture (*Zeit. f. Pflanzenkrank., July,* 1912; *R. Ewert*).—From experiments carried out from 1905 onwards it was sought to discover whether the increased yield resulting from spraying with Bordeaux mixture was in any way due to a physiological effect on plants. Experiments with potatoes, radishes, and beans showed the yield to decrease with the increased strength of Bordeaux mixture used. The Bordeaux mixture was found to have a favourable physiological effect only in dry weather, the mixture acting by hindering transpiration from the leaves. It seemed possible that the coating of copper sulphate also acted as a shade to the plant from an excessive amount of sunlight in hot, sunny weather, and thus prevented an early leaf fall. Apart from this, the Bordeaux mixture had no effect on the vitality of the plant (excluding its fungicidal effect).

On the other hand, repeated spraying of currants and gooseberries with Bordeaux mixture had the effect of increasing the sugar content of the sap of the currants and gooseberries. This was shown not to be due to the fungicidal action, as spraying immune varieties of fruits had the same effect, nor to any increased assimilative activity of the leaves, the latter, indeed, decreasing as a result of the spraying.

NOTES ON CO-OPERATION.

Co-operative Cow Insurance Societies in 1911.

In the *Journal* for May, 1912, p. 116, an account was given of the working, during the year 1910, of the twenty-two registered co-operative societies in England and Wales, which deal with the insurance of cows and female calves. Similar statistics are now available for the same societies for the year 1911, and are discussed in the following article.

General Results of the Year's Working.

In 1911, these twenty-two societies had 1,510 members (as compared with 1,631 members in 1910), which gives an average of 69 members per society, the number varying from 12 in one society to 302 in another. The societies insured altogether 4,517 cows and calves (as compared with 4,588 in the previous year), an average of 205 animals insured per society; but the number varies from 12 in one society to 1,363 in another, the average number of animals insured per member being 3·0. The total sum realised as premiums or insurance contributions was £936, which gives an average premium of 4*s.* 2*d.* per animal (as against 4*s.* 0½*d.* in 1910). Besides the premiums, there were other items of income credited to the Insurance Fund, including £10 raised as a levy in one society, £125 received as interest on invested reserve, and £36 from sale of carcasses; and altogether the income of the Insurance Fund for the year amounted to £1,128. Against this the charges were £1,019 paid on insurance claims, and £54, which chiefly represented management expenses irregularly charged to the Insurance Fund, making the total expenditure of that Fund for the year £1,073, and leaving a net surplus for the year of £54, so that the amount at credit of the Insurance Fund rose from £4,793 at the beginning of the year to £4,847 at the end.

The sixteen societies, which, in accordance with the law and rules, kept a separate account of their Management Funds, spent on costs of management £86, which gives an average of a little over 5*d.* per animal insured by them, more than half this amount being expended in salaries. This expenditure was met by contributions and other income, apart from that of the Insurance Fund, amounting to £85, and the Management Funds as a whole showed a balance to their credit at the end of the year of £17. Thus the total assets of these societies, which form in each case an unencumbered Reserve Fund, built up from the savings of past years, amounted altogether to £4,864 (as compared with £4,812 at the beginning of the year). Of this amount £315 was held as cash in hand, and £4,549 was deposited in savings banks at an interest of 2½ per cent. This reserve amounts to more than four and a half times the losses of the year, and goes to protect the members against the risk of having to make a levy on themselves to meet exceptional mortality. Only one society—that at Friskney, in Lincolnshire—had to make a levy of 2*s.* per cow to bring up its Reserve Fund to a satisfactory figure. Each of the twenty-two societies has a reserve of this kind, and two of them, at Whixall and Prees, in Shropshire, have each over £1,000 in the Savings Bank.

The Death-rate.

The most important question for an insurance society is the death-rate to be expected, "death" meaning death in consequence of disease or accident, or in any other way than by being slaughtered in ordinary course for human food. During the year 1911, of the 4,517 cows and calves insured in these twenty-two clubs, 118 died, giving a death-rate for the year of 2·6 per cent. per annum. In the previous year, out of 4,243 animals insured, 94 died during the year, giving an average mortality for that year of 2·2 per cent., so that in this respect 1911 was a worse year than 1910. This was probably due to the dryness of the season, and to the exceptionally plentiful crop of acorns, as several societies report that they lost a number of cows owing to their having eaten too many acorns. Last year seven societies, insuring among them 187 animals, had no losses at all. Of the larger societies, Whixall, with 1,363 animals insured, had a death-rate of only 1·9 per cent., Hanmer, with 1,237 animals, had a death-rate of 3·3 per cent., and Prees, with 537 animals, a death-rate of 2·8 per cent. Putting together the experience of the last two years, we have on an average of 4,380 cows and calves a death-rate of 2·4 per cent. per annum. Statistics have been collected for a longer period for several of these societies, which give a more accurate estimate of the probable average death-rate over a series of years. In each case the average has been worked out for a period of nine or ten years ending 1911.

Name of Society.	Average No. of Animals Insured.	Average No. of Deaths in the Year.	Average Death Rate per Cent. per Annum.
Prees	521	10·8	2·1
Whixall	1,302	27·0	2·1
Wem	198	4·6	2·3
Sutterton	55	1·3	2·4
Hanmer	1,127	29·9	2·7
Moulton Chapel (unregistered) ..	242	6·7	2·8
Friskney	105	4·2	4·0
	3,550	84·5	2·4

According, therefore, to the experience of these seven societies for a series of years, and to the experience of the twenty-two societies during the last two years, a village cow insurance society, consisting mainly of small-holders and cottagers, may reasonably expect that on a series of years its average death-rate will be about 2½ per cent. per annum, which may be reduced by good management to a little over 2 per cent., and may be increased by lax administration or the exceptional unhealthiness of the locality to 3 or even 4 per cent.

It is interesting to compare this experience with that of the owners of cows in other circumstances. Several dairying establishments, owning a considerable number of cows, have been good enough to furnish the Board with information regarding the number of deaths among their dairy stock. One establishment, which, on the average of the last ten years, kept 484 cows, lost 14·4 per annum, which gives an average annual death-rate of 3·0 per cent. per annum, the highest death-rate in any one year being 4·6 and the lowest 1·7. Successful efforts are being made to reduce the death-rate, as is shown by the fact that for the first five years it averaged 3·5 per cent., while for the last five years it averaged only 2·5 per cent. It is worthy of note that in a herd of Jerseys the death-rate for the ten years averaged 8·7 per cent., while for the non-pedigree Shorthorns the average death-rate was only 2·7. Another dairying establishment, which keeps about 200 milking cows, estimates that its average death-rate for the last ten years has not been more than 2 per cent. per annum, the principal causes of death being inflammation of the uterus after a difficult calving, and inflammation of the udder following a chill. In this herd tuberculosis has been practically eliminated by the use of the tuberculin test. A small establishment keeping on the average 83 cows has had an average death-rate in the last six years of 5·4 per cent. per annum; and from the figures furnished by several live stock insurance companies it appears that their experience is that on the average about 6 per cent. of the dairy cows insured with them die every year. There seems, therefore, some ground for the belief that where cows are kept together in herds, however careful the management may be, the death-rate is likely to be higher than where they are kept apart, singly or in small numbers; and the statistics of these registered societies themselves tend to confirm this impression. In the Whixall Club during the last ten years, on an average of 1,302 animals insured, while for the club as a whole the death-rate has averaged 2·1 per cent. per annum, the death-rate for owners who insured less than ten animals each was only 1·9 per cent., while for owners who insured ten or more animals each, it was 2·4 per cent.; similarly in the Hanmer Club, insuring 1,127 animals, with an average death-rate for the ten years of 2·7 per cent., the death-rate for owners insuring less than ten animals each was 2·6, while for owners insuring ten or more animals each it was 2·9. This point is of importance when considering whether the rate of premium which is found sufficient in the case of cows and calves owned in small numbers by small owners would be a safe rate to employ for the insurance of cows owned in larger herds. While it would seem safe for a society consisting of small-holders and cottagers to reckon on an average death-rate of 2·5 per cent., it would be wise for the owners of herds of ten or more cows and calves to reckon on an average death-rate of at least 3 per cent.

Amount Paid on the Death of an Animal.

The amount a society may expect to be called on to pay on the death of an insured animal depends upon the rule on the subject adopted by the society. In the case of cows, of the twenty-two societies eight pay the value of the animal at the time it fell ill up to a maximum of £10; one has fixed the maximum at £8, another at £9, another at £12, and another at £14. One society pays five-sixths of the value, and three pay four-fifths of the value, without limit. One society pays two-thirds of the value, not exceeding £12, £10, or £8, according to the amount of premium paid. Several clubs insure only cows; where heifer calves are insured, the amount payable on death is usually the value up to £5 or £3, and if the calf is under six months old, the amount payable is £2. The actual amount paid in 1911 on 118 animals that died was £1,019, from which has to be deducted £36 received from the sale of carcasses, so that the net loss to the societies was £983, which gives an average loss of £8 7*s.* per animal that died, and of 4*s.* 4*d.* per animal insured. In the previous year the corresponding average was £8 15*s.* per animal that died, and 4*s.* per animal insured. Statistics on this point for nine or ten years in each case are available for the following clubs:—

Society.	Amount payable per Animal.	Average No. of Animals that Died.	Average Loss to Society per Animal.	
			that Died.	Insured.
			£ s. d.	s. d.
Whixall	Value up to £10	27·0	8 3 0	3 5
Hanmer	do. do.	29·9	8 5 0	4 5
Wem	do. do.	4·6	8 4 0	3 10
Prees	do. £10 (raised to £12)	10·8	9 5 0	3 10
Moulton Chapel (unregistered)	Three-fourths value without limit.	6·7	10 5 0	5 8
Friskney...	do. do.	4·2	12 8 0	10 0
Sutterton	Four-fifths value up to £20.	1·3	11 9 0	5 6

It would seem, therefore, that if a new society adopted the rule followed at Whixall, Hanmer, and Wem, of paying the value of an animal subject to a maximum of £10, they might safely estimate that on the average the amount payable per animal that died would not exceed £9, and to pay this amount on 2½ per cent. of the animals insured every year would require a net premium income of 4*s.* 6*d.* per animal. As the average value of a cottager's cow is apparently about £15, perhaps a better rule to adopt would be to pay only four-fifths of the value of the animal at the time it fell ill, subject to a maximum of £12, and to reckon that under this rule the average amount payable would be about £10 on 2½ per cent. of the animals insured, which would require a net premium of 5*s.* per annum per animal insured. It seems to be a good rule not to pay the full value of the animal, so that the owner himself may stand to lose something in the case of its death, and thus be induced by self-interest to keep his animals free from disease, and to do his best for their recovery, if they fall ill.

Amount of Insurance Premiums.

The total amount actually realised in insurance contributions or premiums during the year 1911 was £936, which, on 4,517 animals, gives an average of 4*s*. 2*d*. per animal insured, against a net loss on claims of £983; but the additional income to the Insurance Fund from interest and other items more than redressed the balance, and, as already said, the Insurance Funds showed a profit on the year of £54. The charges made by different clubs for insurance contributions vary considerably. These contributions are usually payable by the quarter, and generally vary for cows from 4*s*. to 6*s*. per annum, but one club charges 8*s*. and another 12*s*. per annum per cow. Societies which have a separate insurance rate for calves usually charge 9*d*. per quarter for each calf. There seems some reason to doubt whether the rate per calf should be less than that per cow. On the one hand the amount payable on the death of a calf is less than the amount payable on a cow, but, on the other hand, the death-rate among calves is considerably higher than that among cows. Taking the figures for the year 1911 for these twenty-two clubs as they stand: of 3,825 cows insured, 89 died, giving a death-rate per cent. per annum of 2·3, while of 692 calves insured 29 died, giving a death-rate for the year of 4·2 per cent. But while a cow is insured as a cow for the whole year, a calf is usually insured as a calf from about six months to about fifteen months old; that is to say, for about nine months in all, so that if the death-rate be worked out by the quarter, instead of by the year, the death-rate for cows was 0·6 per quarter, whereas the death-rate for calves was 1·4 per quarter, or more than double that for cows. Fuller statistics are available for a series of years as regards the following clubs:—

Name of Society.		No. Insured.	Average Number that Died in the Year.	Death Rate per Cent. per Quarter.
Prees	cows...	442	9·1	0·5
	calves	79	1·7	0·7
Whixall	cows...	1,017	18·0	0·4
	calves	285	9·0	1·1
Hanmer	cows	902	22·6	0·6
	calves	225	7·3	1·1
Wem	cows...	155	4·1	0·7
	calves	43	0·5	0·4
Totals	cows...	2,516	53·8	0·5
	calves	632	18·5	1·0

Thus, although the experience of these societies differs considerably, yet taken together it seems to show that a club may expect a death-rate per quarter among calves about double the death-rate per quarter among cows. At Prees during the last ten years the average paid per cow was £10 4*s*., and per calf £4 7*s*. At Whixall the maximum amount payable per cow is £10, and the maximum amount payable per calf is £5. Thus it would seem that the amount payable per calf that dies is not far short of half the amount payable per cow, and that, to cover the risk, the premium payable per quarter should be almost as high per calf as per cow, and as simplicity of accounts is desirable, it would seem best to charge the same rate of quarterly premium for a calf as for a cow, say *1s. 3d.* per quarter all round.

Provision for Special Levies.

There is always the risk that, owing to an exceptionally unfortunate year, or the outbreak of an epidemic, the amount payable by a society on insurance claims may be larger than the amount of funds available, and almost all societies have provided against this risk by laying down in their rules that, when there is a deficiency in the insurance fund, the balance shall be made up by a levy on the members. Some societies leave the method of assessment to be decided by the committee or a general meeting; others lay down that the levy shall be by so much per member, or, what seems fairer, so much per cow. In 1911 only one society had to make such a levy, and in 1910 two societies did so, the extra rate in each case being *2s.* per cow, which proved sufficient to restore the balance of the insurance fund. Societies which have built up a considerable reserve fund, from which temporary deficiencies in the insurance fund may be met, are in little danger of having to make a special levy of this kind, but until a reserve fund has been built up it is always possible that a bad year may require the members to pay something in addition to the ordinary insurance contribution. This risk is not so great as at first sight appears. There has been no outbreak of cattle-plague in this country since 1877, or of pleuro-pneumonia since 1898, and the number of animals affected by anthrax, or even by foot-and-mouth disease, on the average of a series of years, has been only a small fraction of the total number of cattle in the country, so that the risk to any particular cow of being affected by any of these diseases, or slaughtered in consequence of an outbreak of any of them, is very small. Moreover, if an animal not itself affected is slaughtered by order as a precaution against the spread of cattle-plague, pleuro-pneumonia, or foot-and-mouth disease, its full value is payable by the Board of Agriculture, and no loss in that case falls upon the society. Even if an animal itself affected by one of these diseases is slaughtered by order, the Board pays part of its value to the owner. As a matter of fact, none of the seven societies whose affairs for the last ten years have been investigated has suffered from any such epidemic, the highest death-rate during that period being at Friskney, where in one year the death-rate on 113 cows was 7·1 per cent.; in the larger societies the highest death-rate in any one year has been as follows:—

Whixall	2·8
Hanmer	3·4
Prees	3·3

Still, it is desirable for a society to provide as far as possible against the risk of having to make a heavy levy, especially in the first years of its working, and it should not be difficult to arrange with an insurance company to relieve the society, for a small payment, of its risks in the matter of deaths from anthrax, fire and lightning, and perhaps it may be possible to arrange a system of re-insurance by which some insurance company would relieve the society almost entirely from the risk of having to make a heavy levy from any cause, without lessening the interest of the members in the economical administration of the society.

The Reserve Fund.

On the other hand, the experience of these societies shows that even with comparatively low rates of premium, the excellence of the management and the lowness of the death-rate may result in the accumulation of a large reserve fund. Several societies have provided for this contingency by laying down in the rules that any sum accumulated in excess of a certain amount, in some cases £200, in other cases £1,000, shall be divided among the members, according to the duration of each man's membership; and some years ago the Whixall Society actually distributed among its members £561 of its accumulated reserve fund. Other societies have provided more wisely that when the reserve fund exceeds a certain limit, the insurance contributions payable by members of a certain standing shall be reduced, and it is under the operation of a rule of this character that the Kemerton and Bredon Pig Clubs now actually insure the pigs of all members of over four years' standing for a total annual payment of 8*d.* per pig, and that the Prees Cow Club has recently reduced the total charge made to members of ten years' standing to 3*s.* per cow per annum. The reserve funds of these twenty-two cow insurance societies now amount to £4,847 on 4,517 cows and calves insured, which gives an average reserve of over £1 per animal, and as the average annual net loss per animal insured is a little over 4*s.* per head, this reserve is enough in itself, apart from the annual insurance premiums, to pay the losses of five average years. This ought to be enough to aim at as a reserve fund, and societies might well lay down that whenever the balance at credit of the insurance fund exceeds £1 per animal insured, the members of over five years' standing, to whose good management the accumulation is due, shall be given the advantage of the society's sound financial position, either by an increase of benefits or by a reduction in the rate of contribution.

Model Rules for New Societies.

From the experience of these societies it appears that a community of small-holders and cottagers in any part of the country, which is not exceptionally unhealthy for cattle, might safely form a co-operative mutual insurance society, and arrange to pay any member who might lose his cow or heifer-calf from disease or accident four-fifths of its value up to a limit of £12 per animal, on payment of an insurance contribution of 1*s.* 3*d.* per quarter (that is, at the rate of 5*s.* per annum) and a management contribution of 3*d.* per quarter on each animal insured, making a total payment of 6*s.* per cow or heifer-calf

COW INSURANCE SOCIETIES IN ENGLAND AND WALES REGISTERED AT THE END OF 1911.

Serial Number.	Name of Society.	County.	Year of Registration.	No. of Members.	Number of Animals Insured.			Number of Animals on which Claims were Paid during the Year.			Insurance Fund.							
											Amount at the beginning of the year		Income.					
					Cows.	Calves.	Total.	Cows.	Calves.	Total.			Insurance Contributions.		Interest.		Sale of Carcasses.	
											£	s.	£	s.	£	s.	£	s.
1	Mawdesley	Lancaster	1807	28	46	—	46	1	—	1	45	4	18	2	—		—	
2	Croston	Lancaster... ...	1843	12	12	—	12	—	—	—	26	6	6	0	0	14	—	
3	Matfen	Northumberland	1851	22	34	—	34	1	—	1	14	9	10	7	0	8	—	
4	Tideswell	Derby	1838	21	27	—	27	—	—	—	237	12	6	5	7	19	—	
5	Whixall	Salop	1842	302	1078	285	1363	17	9	26	1176	8	261	5	27	8	—	
6	Prees	Salop	1838	179	453	84	537	12	3	15	1049	17	107	16	26	12	6	4
7	Tilstock	Salop	1859	54	112	4	116	2	—	2	206	13	31	7	4	10	—	
8	Friskney	Lincoln	1853	70	104	—	104	4	—	4	73	5	31	4	1	6	2	5
9	Hanmer	Flint...	1862	270	984	253	1237	25	16	41	476	5	204	3	12	10	16	16
10	Beeley	Derby	1863	28	28	—	28	1	—	1	93	15	2	16	2	7	—	
11	Hunmanby	York...	1866	47	73	—	73	1	—	1	210	13	24	8	5	14	0	10
12	Wem	Salop	1871	67	199	45	244	11	—	11	173	9	57	6	16	1	6	18
13	Sutterton...	Lincoln	1861	29	51	—	51	—	—	—	127	8	18	2	3	15	—	
14	Brompton	York...	1873	12	24	—	24	—	—	—	53	16	4	18	1	6	—	
15	Sibsey	Lincoln	1874	62	45	—	45	3	—	3	161	5	27	18	3	0	1	10
16	Hodnet	Salop	1877	48	83	3	86	5	—	5	166	14	20	15	3	18	—	
17	Middle Rasen...	Lincoln	1883	21	44	—	44	1	—	1	26	13	13	4	0	14	—	
18	Caythorpe (Normanton)	Lincoln	1886	16	25	—	25	—	—	—	35	8	5	12	—		—	
19	Ellesmere	Salop	1887	112	200	18	218	3	1	4	243	1	43	7	3	0	—	
20	Uppermill	York...	1889	15	28	—	28	—	—	—	58	10	8	16	1	11	—	
21	Belsay	Northumberland	1890	24	20	—	20	—	—	—	107	14	4	12	2	5	—	
22	Burleydam	Chester	1909	71	155	—	155	2	—	2	28	5	28	1	0	4	2	0
		Total	...	1510	3825	692	4517	89	29	118	4792	10	936	4	125	2	36	3

COW INSURANCE SOCIETIES IN ENGLAND AND WALES REGISTERED AT THE END OF 1911 (*Continued.*)

Serial Number.	Name of Society.	County.	Insurance Fund (*cont.*).						Management Fund.		Assets.	
			Income (*cont.*).		Expenditure.			Amount at the end of the Year.	Income.	Expenditure.	Deposits in Banks and Investments.	Total Assets.
			Other Income.	Total Income.	Paid on Claims.	Other Payments.	Total Payments.					
			£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
1	Mawdesley	Lancaster	—	18 2	8 0	—	8 0	55 6	4 16	4 16	—	55 6
2	Croston	Lancaster	—	6 14	—	—	—	33 0	0 9	0 9	33 0	33 0
3	Matfen	Northumberland	0 15	11 10	10 0	1 4	11 4	14 15	—	—	—	14 15
4	Tideswell	Derby	—	14 4	—	5 13	5 13	246 3	—	—	246 1	246 3
5	Whixall	Salop	3 15	292 8	210 0	—	210 0	1258 16	24 7	24 7	1127 13	1258 16
6	Prees...	Salop	2 2	142 14	152 0	—	152 0	1040 11	5 7	5 7	1036 6	1040 11
7	Tilstock	Salop	—	35 17	19 0	3 15	22 15	219 15	—	—	196 2	219 15
8	Friskney	Lincoln	11 18	46 13	51 11	—	51 11	68 7	2 16	4 5	28 5	66 18
9	Hanmer	Flint	0 10	233 19	305 10	—	305 10	404 14	25 0	23 10	407 15	407 15
10	Beeley	Derby	2 10	7 13	8 12	—	8 12	92 16	0 10	0 10	92 14	92 16
11	Hunmanby	York...	1 18	32 10	15 16	3 10	19 6	223 17	—	—	220 6	223 17
12	Wem..	Salop	0 10	80 15	100 0	8 10	108 10	145 14	—	—	118 3	145 14
13	Sutterton	Lincoln	—	21 17	—	4 18	4 18	144 7	—	—	144 7	144 7
14	Brompton...	York...	1 11	7 15	—	24 15	24 15	36 16	0 10	0 10	36 16	36 16
15	Sibsey	Lincoln	—	32 8	36 13	—	36 13	157 0	5 13	5 17	157 0	157 0
16	Hodnet	Salop	—	24 13	41 16	—	41 16	149 11	2 8	1 12	151 1	152 18
17	Middle Rasen	Lincoln	—	13 18	8 6	—	8 6	32 5	3 6	3 0	33 18	34 3
18	Caythorpe (Normanton)...	Lincoln	0 5	5 17	—	—	—	41 5	0 13	0 11	41 5	48 3
19	Ellesmere...	Salop	2 2	48 9	32 0	2 0	34 0	257 10	4 9	5 2	258 5	258 5
20	Uppermill	York...	—	10 7	—	—	—	68 17	1 16	1 8	68 17	69 19
21	Belsay	Northumberland	—	6 17	—	—	—	114 11	0 17	1 13	108 4	114 8
22	Burleydam	Chester	2 10	32 15	20 0	—	20 0	41 0	1 15	3 8	42 14	42 14
		Total	30 6	1127 15	1019 4	54 5	1073 9	4846 16	84 12	86 5	4548 12	4863 19

per annum, with the expectation that after a few years a sufficient reserve fund would be accumulated to justify the society in reducing the rate of insurance contribution, say, by 1*s.* per annum, to 4*s.*, which is the rate now charged by the prosperous Whixall, Hanmer, and Prees Cow Clubs. This rate compares very favourably with that charged by the large live-stock insurance companies, which generally require on dairy cows a premium of 7½ per cent. on the maximum value insured, which would come to 18*s.* per annum for a maximum payment of £12 per animal.

In the *Journal* for August, 1912, p. 388, a detailed account was given of the working of the Prees Cottagers' Cow Club in Shropshire; the two largest clubs are the Whixall Club, also in Shropshire, and the Hanmer Club, not far off, in Flintshire.

The Whixall Cow Insurance Society.

The Whixall Cow Insurance Society was founded in 1842, and registered in 1857. It now consists of 302 members, and insures 1,363 cows and calves. The members are almost all small-holders, and many of them own their own holdings. The rate of premium charged is 1*s.* per quarter for each cow and 9*d.* per quarter for each calf, and the society pays on the loss of a cow its value not exceeding £10, and on a calf its value not exceeding £5. On the average of the last ten years, the death-rate has been only 2·1 per cent. per annum. The society paid altogether an average of £220 per annum, which comes to only 3*s.* 5*d.* per animal insured, while the amount received in premiums averaged £245 per annum, or 3*s.* 9*d.* per animal insured. There was also an average annual income of £29 from interest on the reserve fund, and of £10 from the sale of carcasses and hides, and the insurance fund showed an annual surplus of £69. At the beginning of the ten years the reserve amounted to £1,217, and if the society had not distributed a dividend of £561 among its members, it would now have amounted to £1,820; even after distribution of that dividend, it stood at £1,259 at the end of last year. The costs of management averaged less than 4*d.* per annum per animal insured.

The Hanmer Cow Insurance Society.

The Hanmer Cow Insurance Society was founded in 1862, and now consists of 270 members, and insures 1,237 cows and calves. It pays its members the full value not exceeding £10 on any cow that dies, and a maximum of £4 on a heifer-calf. The insurance contribution rates are the same as at Whixall. On the average of the last nine years, the death-rate has been 2·7 per cent. per annum; the average amount paid on claims was £246 per annum, while the actual average income from premiums was only £189, and even after adding to this the average income of £13 from interest and £21 from sale of carcasses, the total income of the insurance fund averaged only £223, so that the reserve was depleted at the average rate of about £23 per annum, and during the nine years the amount at credit of that fund actually fell from £597 to £405. The society, notwithstanding the decrease in the reserve, is still in a sound financial position. The main cause of its having a less satisfactory recent history than the Whixall and Prees Clubs is that its average death-rate has been 2.7 per cent. per annum, against 2·1 per cent., the very low rate attained by the other two clubs. Unless it can succeed in reducing that death rate it would be well to increase the rate of insurance contribution from 1*s*. per quarter for cows and 9*d*. per quarter for calves to 1*s*. 3*d*. per quarter for each animal insured, until the insurance fund shows a satisfactory average rate of increase instead of diminution.

Insurance Clubs for Larger Farmers.

There seems nothing to prevent larger farmers, if they will only co-operate, from following the example of these small-holders and forming mutual insurance societies for cows and calves on similar lines; but, for the reasons already given, it seems probable that the death-rate among larger herds would be higher than it is among cows owned in small numbers, and generally kept separate from each other and individually looked after by their owners. Probably also the cost of management of such a society would be somewhat higher than in the case of village cow clubs. Still, it would seem safe for a farmers' mutual insurance society to undertake to pay its members four-fifths of the value of a cow or heifer-calf that died from disease or accident up to a maximum of £12, on payment of an insurance contribution of 8*s*. per annum per cow or calf insured, and of 2*s*. per annum as management contribution, or 10*s*. altogether per animal, as against 18*s*. or more that would be charged by a live stock insurance company to cover a similar risk; with the expectation that after some years' experience had been gained, and a reserve fund built up, they would be in a position to reduce the rate of insurance contribution.

Whissonsett Small Holders' Credit Society.

Whissonsett is a small agricultural village in Norfolk, some five miles from Fakenham. The parish has a total area under crops and grass of about 1,200 acres, of which 900 acres are arable land, and nearly 300 acres are under permanent grass. Agricultural operations are mainly confined to stock-raising and growing corn and roots. Last year there were in the parish about 25 holdings of between one and fifty acres.

Some years ago the Lincolnshire and Norfolk Small Holdings Association, Ltd., bought a farm close to the village, of an area of 97 acres. At present this land is held by 16 tenants, paying at from 22*s*. 6*d*. to 25*s*. an acre rent for the arable land, and 30*s*. an acre for the meadow land (about 42 acres), on which the Association spent about £100 for fencing. In 1910 the County Council acquired a farm near the village of an area of 181 acres, and let it in ten holdings, varying from 8 to 27 acres, at a total rent of £261, averaging 29*s*. per acre (including rent of farm buildings). There has thus recently been a considerable increase in the number of small holdings in the parish.

In 1905 a number of small holders started a Co-operative Credit Society. It began with 18 members, and the number has now increased to 26, some of whom are small farmers, some shop-keepers or artisans who have taken a small holding as an addition to their ordinary occupation, and some working-men. Most of the members hold land, and three of them own their holdings. The Provident Allotment Club, which had been instituted in 1901, handed over to the Credit Society its balance of deposits, amounting to £23, and the Society laid down a rule that every member should add to his deposit at least 2*s*. 6*d*. every quarter, or be deprived of his interest. The deposits by members have thus grown until at the end of 1911 they amounted to £85, on which 3 per cent. interest is paid. During the six years since the Society started, it has made 35 loans to its members, amounting in all to £227, and averaging £6 10*s*. On these loans the members pay to the Society interest at 5 per cent. Loans are granted only for purposes connected with agriculture, and only in cases in which the Committee has satisfied itself that the loan will prove profitable to the borrower, who is required to find two sureties for its punctual repayment. The loans granted have been mainly utilised for the purchase of pigs, cattle, horses, sheep, seed, manure, or implements. They are generally repayable after 12 months, but one has been made repayable in two years by half-yearly instalments.

The first loan taken by a member was one of £5, with which, aided by some money of his own, he bought seven pigs for £7 7*s*. In about three months he sold them at a profit of £7 7*s*. Another member, by borrowing £3 from the Society, was able to spend £5 on the purchase of young stock, and made within the year a clear profit of £5.

Last year the Committee had £85 available from deposits made entirely by the members themselves. During the year they granted six loans, amounting to £71, and averaging £12 per loan. Towards the end of the year they obtained an advance of £50 from a well-wisher of the co-operative movement, on business terms, the rate of interest being fixed at 4 per cent., and a year's notice of withdrawal allowed. Altogether, at the end of the year their assets amounted to £139 6*s*. 7*d*., of which £91 was out on loan to members at 5 per cent., and £48 6*s*. 7*d*. deposited with the London and Provincial Bank, which allowed the Society 2½ per cent. interest. Their liabilities were £84 15*s*. 3*d*. due on deposits to members, and the £50 recently borrowed, total £134 15*s*. 3*d*.; so that they had a surplus or reserve fund of £4 11*s*. 4*d*.

The interesting features of this society's working are (1) that, unlike other credit societies, it has made a special levy of 1*s*. per member to pay the salary of the assistant secretary, and (2) that for the first six years of its existence it was content to work with capital provided by deposits made by the members themselves, without borrowing any money from outside. This made the society self-supporting, but restricted its power to meet the needs of its members by way of loan, and since the close of the year the advance of £50 obtained by the Society has enabled it to make some larger loans to members whose operations were hampered by want of capital. It has now secured the services of a local bank manager as one of its auditors, and has resolved to keep its accumulated profits in a separate deposit account, as a true reserve fund, to be drawn on only with the special consent of a general meeting.

OFFICIAL NOTICES AND CIRCULARS.

Foot-and-Mouth Disease.

In view of the fact that no outbreak of Foot-and-Mouth Disease had been confirmed in Great Britain since October 8th last, the Board on the 26th ult. withdrew all the remaining restrictions on the movement of animals imposed by them in connection with the outbreaks confirmed prior to or on October 8th. On the 1st inst., however, an outbreak of the disease was confirmed amongst cattle at Wilmington Farm, Kennington, near Ashford, Kent. The usual precautions were at once taken by the Board to prevent the spread of the disease, and an Order was issued prohibiting the movement of animals in a large area surrounding the affected farm. In consequence of the arrival at the Birkenhead Foreign Animals Wharf on the 4th inst. of an animal from Ireland which was found on examination by the Veterinary Inspectors of the Board to be affected with the disease, the Board on the same day issued an Order prohibiting, for the time being, the landing in Great Britain of cattle, sheep, goats, or swine from any part of Ireland. Four other animals which formed part of the same cargo were subsequently found to be affected with the disease. All the animals were slaughtered within the wharf.

The Irish Department having prohibited movement of animals out of a large area in Ulster and Leinster, the Board on the 11th inst. again permitted the landing of animals for slaughter within the landing places.

Regulations for the Show of Thoroughbred Stallions, 1913.

The show of thoroughbred stallions suitable for getting half-bred horses will be held by the Board at the Royal Agricultural Hall, Islington, in conjunction with the Hunters' Improvement and National Light Horse Breeding Society, on March 11th, 12th, and 13th, 1913.

King's Champion Challenge Cup.—His Majesty the King has been graciously pleased to offer for competition a cup for the Champion Stallion in the show to which a King's Premium is awarded, to be selected from amongst the stallions recommended for Super-Premiums. The cup will be held by the winner for one year only, and shall then be returned to the Board of Agriculture and Fisheries. A gold medal will also be awarded by the Board of Agriculture and Fisheries to the owner of the Champion Stallion.

King's Premiums.—Forty-four King's Premiums are offered by the Board of Agriculture and Fisheries for award to Thoroughbred Stallions, not under four or over twenty years old, to travel prescribed districts in England and Wales.

The average value of a Premium is £197 12*s.* 6*d.*, paid by the Board, as follows:—

	£	s.	d.
Premium of 100 guineas—half paid at the time of award, and the other half after the close of the service season	105	0	0
Service fee of £1 1*s.* a mare (average number, 65), paid after the close of the service season	68	5	0
Foal fee of 12*s.* 6*d.* a foal (average number, 39), paid after the close of the foaling season	24	7	6
	197	12	6
In addition, a service fee of £2 a mare (average number, 65) is chargeable to the owner	130	0	0
Average earnings	327	12	6

Fees are paid by the Board in respect of (but not exceeding) 90 mares, and the earnings of a stallion serving that number would be approximately £410.

Super-Premiums of the value of 100 guineas, paid at the time of award, will, in addition to the ordinary Premium, be given to selected stallions of exceptional merit. Not more than 10 will be awarded in 1913.

The owner of a stallion is required to state on the entry form whether he enters his stallion for competition for a Super-Premium. If he does so enter it, he is to sign an undertaking agreeing that the stallion shall be exhibited (if awarded a Super-Premium in 1913) at the show of Premium Stallions in 1914 in a class for which it is eligible in accordance with the Regulations of the Board.

If the stallion is not so exhibited the owner is to forfeit and pay to the Board the value of the Super-Premium, *i.e.*, One Hundred Guineas.

Copies of the regulations, conditions of awards, entry, and service, and entry forms, may be obtained from the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W.

International Year-book of Agricultural Legislation.

The International Institute of Agriculture at Rome has just published in French its first International Yearbook of Agricultural Legislation (*Annuaire international de législation agricole*, 1911), which supplies particulars of the principal laws and regulations relating to agriculture throughout the world. The information is classified under the following subjects:—(1) Agricultural and trade statistics; (2) trade in agricultural products, fertilisers and live stock; (3) finance and customs duties affecting agriculture; (4) plant production and trade; (5) animal production and trade; (6) agricultural education and institutions; (7) plant diseases, plants and animals injurious to agriculture; (8) agricultural co-operation, insurance, and credit; (9) rural property, land colonisation at home; (10) capital and labour in relation to agriculture; (11) rural sanitation, rural administrative control. The full text is given of all fundamental laws, and of others when a summary is not considered sufficient.

The volume may be obtained from the Board of Agriculture and Fisheries, 8 Whitehall Place, London, S.W.; price 8*s.* 4*d.*, post free.

Vacancy for a General Inspector in the Horticultural Branch.

The Board of Agriculture and Fisheries are prepared to receive applications for the vacant post of General Inspector in their Horticultural Branch.

The salary attached to the post is £400, rising by annual increments to £500.

Candidates must be between 30 and 40 years of age, and should possess a practical knowledge of commercial fruit culture.

Applications should be addressed to the Secretary, Board of Agriculture and Fisheries, 3 St. James's Square, London, S.W., on or before January 1st, 1913.

MISCELLANEOUS NOTES.

Report of the Development Commissioners.

The Second Report of the Development Commissioners (H.C. 305, price 8*d.*) gives an account of the proceedings of the Commissioners during the year ended March 31st, 1912.

The Commissioners state that they are dealing with the problem of the development of agriculture and rural industries by devoting their attention principally to three lines of action; first, to increasing the amount and quality of the product of agriculture by assisting the extension of scientific investigation, research, and education; second, to increasing the variety of production by placing the cultivator in a position to know whether he can add certain new crops and industries to the existing number with a reasonable probability of profit; third, to improving the commercial methods applied in the business of agriculture by promoting the organisation of co-operation.

Scientific Investigation, Research, and Education.—With regard to research in agricultural science, the Commissioners explain that two principles have been kept in view: first, that what may be called pure research is not a local matter, and consequently the proper division of effort is not by geographical districts; and, secondly, that in order to be really effective it must be continuous and concentrated. Several separate institutions, each attacking parts of several different subjects, are not likely to serve the advancement of knowledge so well as if each of them devoted its main efforts to one branch of investigation. Attempts have therefore been made to divide agricultural science into eleven main branches, and to provide for systematic research into each of these at one or two institutions devoted to that subject. In determining where these institutions should be the Board of Agriculture and Fisheries and the Commissioners have taken into account the desirability of keeping research and education in close touch with one another, and also the existence at particular places of a traditional connection with some particular branch of agricultural science and of a staff fitted to deal with it.

The schemes for the extension of a system of education fall under two main heads: first, the division of England and Wales into twelve areas, each centred round an agricultural college, and grants to those colleges to enable them to demonstrate the application of known results to local conditions and to provide technical advice to local agriculturists; secondly, grants to county councils to enable them to provide or extend farm institutes or schools—educational centres which will give short winter courses or similar instruction, and also be the headquarters of an increased county staff of itinerant teachers, advisers, and organisers.

When these schemes are in full operation the Commissioners hope to see an organic system of research, technical advice, and education covering the whole of England and Wales. At the head will be the research institutes, each carrying forward the investigation of a particular branch of agricultural science, and, with similar Irish and Scotch institutions, covering practically the whole field of that science. Next there will be the colleges, whose duty it will be to provide the highest form of education in agriculture, to demonstrate by experiment the application to local conditions of the results obtained by the research institute, and to advise farmers within their areas on the more difficult problems of practice. Last, there will be the farm institutes, closely connected with the colleges, providing education for classes to whom the long college course is unnecessary or impossible, and finally by means of the itinerant county staff centred at them, advising the farmers in the simpler and less far-reaching difficulties which require for their solution no great scientific knowledge or prolonged scientific training.

Although the main outlines of a system of research, technical advice, and instruction in agriculture have been settled, the Commissioners are well aware that it is still incomplete in various particulars, and that for its full efficiency some further funds will need to be provided beyond the grant of £50,000 a year for research and technical advice, and the sum of £325,000 allocated for farm institutes and agricultural instruction in England and Wales. Some at least of the colleges require assistance for necessary buildings, farms, and equipment. A certain number of farm institutes will need land for the proper performance of their functions; existing experimental farms worked by local authorities or associations of agriculturists often both deserve and require support, which may, moreover, at a comparatively small expense, afford the means and opportunity of co-ordinating local efforts at present disconnected.

Agricultural Co-operation.—The arrangements for assisting the organisation of co-operation in Great Britain have been settled in outline. The principle adopted by the Commissioners has been in substance to utilise the existing voluntary societies which have done the work in the past, and entrust its extension to those bodies, reconstituted and strengthened by the admission of representative elements from outside. Two reasons have weighed with the Commissioners in adopting this policy. In the first place, they think that co-operation is particularly the kind of movement in which it is essential to retain the enthusiasm of voluntary workers. They fear that the grant of Government assistance, and the consequent measure of Government control, may to some extent weaken the spontaneous character of the movement; but they feel that it has a better chance of surviving under the arrangements now made, than if the necessary assistance which the Commissioners were glad to supply had been given to official bodies. Secondly, the geographical and other limitations of the available public authorities, at least in England and Wales, render them inconvenient and probably expensive agents for this particular purpose. The natural co-operative divisions of the country do not follow county boundaries, nor is the area which one organiser and his assistants can cover confined to one county.

It was stated in the Commissioners' previous report that they had decided to prepare a scheme for the constitution of a representative association, possibly based upon a re-organisation of the existing Agricultural Organisation Society, to which might be entrusted the expenditure of the sums required for the promotion of co-operation. The Board of Agriculture and Fisheries accepted this proposal, and after several conferences between representatives of the Commissioners, the Board, and the Society, arrangements were made for reconstituting the Society as a company not trading for profit and retaining its former name.*

Meanwhile the Commissioners, in consultation with the Board, had agreed to recommend an interim grant to the existing Society, to enable its work to be carried on pending the establishment of the new body. On July 13th they recommended the Treasury to make a grant of £3,000 to be held by the Board in trust for the Society.

Forestry.—In the case of forestry the Commissioners have formulated the principle that education and provision of technical advice are the best lines of advance for the immediate present, and in accordance with this principle they have recommended grants of £500 a year in aid of technical advice and instruction at each of five centres in England and Wales—Oxford, Cambridge, Cirencester, Bangor, and Newcastle,—further grants amounting to £1,200 a year in aid of research work, and a grant of £1,000 for minor forestry experiments. All these grants are necessarily provisional, pending the establishment of a central demonstration area, where, in the Commissioners' opinion, a great—perhaps the principal—part of the State-aided educational and research work in forestry should be centred. The Commissioners think that such an area may be found among the existing Crown woods, in which case the heavy cost of acquiring a privately-owned forest would be avoided.

Meanwhile the Commissioners see no reason why local authorities should not be assisted by loans on easy terms to afforest suitable land under their control, such as water catchment areas. They have already received a few schemes; but desiring to encourage local activity in this direction they have issued a public notice and drawn to it the special attention of some of the authorities who are known to control land not under wood. If this invitation produces a satisfactory response from the authorities, they hope that it may prove possible at a comparatively small cost to the State to add considerably to the afforested areas of the country, and incidentally to gain experience which may be of value to the State, to local authorities, and to private owners.

---

* A note as to the reconstitution of the Society appeared in the *Journal* for Nov., 1912, p. 693.

The Report also deals with numerous other grants or proposals for grants made in the course of the year in connection with other aspects of agriculture or economic development coming within the scope of the Act.

Importation Regulations.

Importation of Nursery Stock, &c., into the United States.—The following Regulations were made by the Secretary of Agriculture of the United States on September 18th, 1912, with regard to the importation into the United States of nursery stock (*U.S. Dept. of Agric., Office of the Secretary, Circular No.* 41).

Definition.—The term "nursery stock" includes all field-grown florist's stock, trees, shrubs, vines, cuttings, grafts, scions, buds, fruit pits, and other seeds of fruit and ornamental trees or shrubs, and other plants and plant products for propagation, but does not include field, vegetable, and flower seeds, bedding plants, and other herbaceous plants, bulbs, and roots. All woody plants and parts thereof for propagation or planting are included within the term "nursery stock."

Permits for Importation.—Persons wishing to import nursery stock must apply to the Secretary of Agriculture for a permit, stating the general nature and quantity of the nursery stock, the district or locality where grown, the name and address of the exporter, together with the name and address of the importer in the United States and the proposed port of entry. Applications for permits should be made in advance of the shipment of the nursery stock, but if through no fault of the importer, stock shall arrive before the issue of a permit, the stock will be held in customs custody at the risk and expense of the importer for a period not exceeding ten days, pending the issue of a permit.

On approval by the Secretary of Agriculture of an application for the importation of nursery stock from countries which maintain nursery stock inspection, a permit will be issued. Permits will expire on the 30th day of June of the year following the date of issue.

Entry of Nursery Stock.—Entry of nursery stock will not be allowed unless accompanied by a certificate issued by a duly authorised official of the country from which it is shipped, stating that it has been thoroughly inspected by him or under his direction, and was found, or believed to be, free from injurious plant diseases and insect pests. In the case of stock to be shipped between October 1st and May 31st this inspection must be made on or after October 1st, and for stock shipped during the growing season inspection must be made not more than 30 days prior to date of shipment. Until July 31st, 1913, however, the usual inspection certificate covering the previous growing season will be accepted. When the country from which any nursery stock is shipped maintains no official inspection, articles for which a permit has been issued will be admitted only through the ports of

New York, San Francisco, Seattle, Jacksonville, and New Orleans, after examination by inspectors of the Department of Agriculture at the port of arrival, if found to be free from plant diseases and insect pests.

Entry will not be allowed unless the case, box, &c., is plainly and correctly marked to show the number of permit, the general nature and quantity of the contents, the district or locality and country where grown, the name and address of the exporter, and the name and address of the importer.

Nursery stock offered for importation without compliance with these regulations will be refused admission. Nursery stock, inspected as provided, which is found to be carrying dangerous insects or plant diseases, may be treated or destroyed, as circumstances require.

Foreign Certificate of Inspection.—Certificates of inspection will be accepted if countersigned by duly authorised officials of foreign countries or their agents. On and after July 1st, 1913, certificates must give the date of inspection, name of the grower, the district or locality and country where grown, a statement that the stock has been inspected by a duly authorised official, and found, or believed to be, free from dangerous insects and plant diseases, and must bear the name of the responsible inspection official for the country of origin.

Declaration.—On and after December 1st, 1912, all shipments of nursery stock to the United States from countries which maintain an official system of nursery stock inspection must be accompanied by a declaration of the shipper, produced before an American consular officer. The declaration must contain a statement by the shipper that he believes the nursery stock to contain no injurious plant diseases or insect pests, the district or locality and country where grown, the name of the grower, the port of origin, and destination of the consignment, the date of inspection of the stock, and the name of the inspector, and the number of the permit issued by the Secretary of Agriculture.

On and after December 1st, 1912, consular invoices covering shipments of nursery stock to the United States must bear the number of the permit issued by the Secretary of Agriculture, and have attached to them the shippers' declaration.

Importation of Potatoes into the United States.—The importation from the United Kingdom of the common species of the potato and of the horticultural varieties of *Solanum etuberosum* into the United States is prohibited by an order of the United States Department of Agriculture of September 28th, 1912, on account of the prevalence of wart disease in this country.

Importation of Potatoes into Southern Rhodesia.—The Regulations governing the importation of potatoes into Southern Rhodesia, which were given in this *Journal* for May, 1910, p. 153, have been cancelled, and new Regulations of October 3rd, 1912, substituted.

The new Regulations provide that no person shall introduce into Southern Rhodesia from outside British South Africa any consignment of potatoes unless accompanied by a statement on oath from the consignor stating fully in what country, and district of that country, the potatoes were grown, and a certificate from the Department of Agriculture or other responsible Government body or official institution of that country to the effect that the disease known as "warty disease" or "black scab," caused by the fungus, *Synchitrium endobioticum,* Percival, is not known to occur on the farm or premises on which the potatoes were grown. Any consignments not accompanied by such documents will be liable to be seized and destroyed.

Any consignment of potatoes imported from other parts of South Africa, or from oversea, if found on inspection to be infested with "root gall worm" (*Heterodera radicicola*) will be refused admission to Southern Rhodesia or destroyed.

Should any consignment on arrival be found to be infested with "warty disease" or "black scab" it will be totally destroyed.

Notes on Agriculture Abroad.

International Agricultural Exhibition at Ghent in 1913.—The International Agricultural Exhibition which is to be opened at Ghent on April 26th, 1913, promises to make an unusually strong appeal to everyone interested in agriculture and country life generally; a very large undertaking in connection with the exhibition is to be an "ideal village." From an English point of view the dairies will probably be the most interesting part of the display. There will be one in each of two farms of the village, and also a co-operative dairy on a larger scale, fitted with the very latest machinery and according to the most recent ideas. The farms will also be stocked with animals and machinery, while a series of competitions in shoeing and the repair of farm implements will be held at the blacksmith's shop of the village. Horse and cattle shows and ploughing competitions will also be held during the run of the Exhibition. Beside the actual village buildings a number of halls for the display of agricultural machinery have been built.

The Ghent Exhibition as a whole covers, roughly, 250 acres, about 50 acres more than the Brussels Exhibition, and will be the most important one since the Paris Exhibition of 1900. The English pavilion will be practically filled with a machinery exhibit.

The tenth International Congress on Agriculture will be held at the Exhibition from June 8th to 13th, under the patronage of the King of Belgium. A note as to the subjects for discussion appeared in this *Journal* for September, 1912, p. 501.

Agricultural Exhibition at Auckland, New Zealand, in 1913-14.—The Board are informed by the High Commissioner for New Zealand that an industrial, agricultural, and mining exhibition will be opened at Auckland, New Zealand, on December 1st, 1913. While the exhibition is not an international affair, exhibits will be accepted from any part of the British Empire, if they are likely to prove of an attractive nature, and there will likewise be a number of exhibits from the Continent. The buildings in connection with the exhibition will cover about 4 acres, and the grounds will be about 35 acres in extent. The exhibition will be open for at least three months.

All inquiries as to space, exhibits, &c., should be addressed to the London Commissioners:—Moss Davis, Esq., 15 Park Street, S.W., and Leo Myers, Esq., Queen's Gate Hotel, 97 Queen's Gate, Kensington, S.W.

International Agricultural Exhibition at The Hague in 1913.—With reference to the notice as to this exhibition, which appeared in this *Journal* for February, 1912, p. 955, it is now stated, in the recently issued programme, that the exhibition will be held from September 3rd to 15th, 1913, and not in August, as at first announced. Exhibits which are unsold at the close of the exhibition will be conveyed, free of charge, or at reduced rates, to the Dutch frontier, and arrangements have been made with English railway companies whereby the latter will convey the returned exhibits at half-rates under certain conditions. The programme also contains information as to the formalities to be observed in importing and exporting exhibits. Copies of the programme may be obtained from the office of the exhibition, 42 Buitenhof, The Hague.

Free Carriage of Pedigree Live Stock to South Africa.—In connection with the recent Ocean Mail Contract entered into between the Union Government of South Africa and the Union-Castle Steamship Co., Ltd., the latter Company, in order to assist in the agricultural development of South Africa, have undertaken to carry free of freight certain pedigree stock intended for breeding purposes in the Union.

The pedigree stock specified includes stallions, mares (excluding racehorse mares), bulls, cows, boars, sows, rams, and ewes. The stock must duly appear in the stud, stock, or herd book of a recognised public association approved by the High Commissioner for the Union. On making application to the Company for free conveyance, the applicant must supply a pedigree of each animal signed by the breeder, and duly attested by at least one credible witness, and certified by the authority of the stud, stock, or herd book in which the animal is entered.

Notes on the Weather in November.

The weather during the *first* week (October 27th to November 2nd) was unsettled at first, with fairer weather later in the week, especially in the eastern half of England. Rain was "heavy" in the south-west and south of England at the beginning of the week. Over the whole week rainfall was "moderate" in Scotland N. and W., and England N.W., and "heavy" elsewhere. Warmth was "moderate" in all districts except Scotland N. Bright sunshine was "scanty" in Scotland N. and E. and England S.W., and "moderate" elsewhere.

Much cloud was experienced over the whole country during the *second* week, and on the earlier days of the week rain was very general. Subsequently, however, little rain fell except in the north and west of Scotland. Temperature was above the average, the excess being more than 3° in the north-west of England and the west of Scotland. Rainfall exceeded the average in Scotland N. and W. and England N.W.; elsewhere it was below. Bright sunshine was either "scanty" or "very scanty" everywhere.

The weather in the *third* week, after being rough and squally, with frequent rain or passing showers during the earlier half of the week, improved gradually in most parts of the country, but rain still fell in places, and there was little sunshine. Warmth was "moderate" in all districts, being slightly below the average. Rainfall exceeded the average in England E. and N.E., and just equalled it in Scotland N. and E., but elsewhere it was below it. Bright sunshine was "scanty" or "very scanty" everywhere.

As a whole the conditions were dull and unsettled in the *fourth* week. Rain fell in slight or moderate quantities daily at many places in the west and north, and on several days in most other parts of the country; some localities in the east and south remained dry, however, throughout the greater part of the week. Over the whole week, rainfall was less than the average, except in Scotland N. Temperature was above the average very generally, while bright sunshine was below the normal except in Scotland N. and E.

The weather was very unsettled in the *fifth* week. Generally there was much cloud, with frequent rain, while late in the week a considerable amount of snow fell over a large area in the north, and a little in some localities in the south. Temperature was above the average very generally, but in Scotland there was a deficit of as much as 5° or 6°. Rainfall was considerably in excess of the average in nearly all districts. Bright sunshine did not differ materially from the normal except in Scotland E.

Produce of Potato and Root Crops.

The following preliminary statement shows the estimated total produce and yield per acre of the potato and roots crops in England and Wales in the year 1912, with comparisons for 1911, and the average yield per acre of the ten years 1902–1911:—

Crops.		Estimated Total Produce.		Acreage.		Average Estimated Yield Per Acre.		Average of the ten years. 1902–1911.
		1912.	1911.	1912.	1911.	1912.	1911.	
		Tons.	Tons.	Acres.	Acres.	Tons.	Tons.	Tons.
Potatoes	England ..	2,113,409	2,674,756	436,948	402,505	4·84	6·65	6·09
	Wales	130,237	175,374	25,955	26,667	5·02	6·58	5·15
	England and Wales ...	2,243,646	2,850,130	462,903	429,172	4·85	6·64	6·03
Turnips and Swedes	England ...	12,075,745	9,316,505	1,015,958	1,066,625	11·89	8·73	13·31
	Wales	812,024	828,874	56,985	57,947	14·25	14·30	15·50
	England and Wales ...	12,887,769	10,145,379	1,072,943	1,124,572	12·01	9·02	13·43
Mangolds	England ...	8,572,196	7,245,902	473,250	438,916	18·11	16·51	19·81
	Wales	217,949	191,322	12,414	11,154	17·56	17·15	17·88
	England and Wales ...	8,790,145	7,437,224	485,664	450,070	18·10	16·52	19·76

NOTE.—The total production of potatoes in England and Wales is estimated at nearly 2,244,000 tons, which represents, on an area of 463,000 acres, a yield of 4·85 tons per acre, the lowest since the returns of produce were first collected, in 1884. The worst return previously was 4·97 tons per acre in 1900. Turnips and swedes have yielded 2¾ million tons more than in the dry season of last year, but the yield per acre, although just 3 tons better than in 1912, is nearly 1¼ tons below the ten years' mean. Mangolds show a similar result, the yield per acre being 1½ tons above last year, but nearly 1¾ tons below the average; their total production is 1½ million tons more than last year.

The preliminary statement of the produce and yield per acre of the corn, pulse, and hay crops was issued on the 1st inst., and that of the produce and yield of hops on October 17th last.

Agricultural Returns for Scotland, 1912.

The Board of Agriculture for Scotland have issued the following statements with regard to the area under crops, and number of live stock in Scotland in 1912, with comparisons for 1911:—

CROPS.

DISTRIBUTION.	1912.	1911.	INCREASE.		DECREASE.	
	Acres.	*Acres.*	*Acres.*	*Per Cent.*	*Acres.*	*Per Cent.*
TOTAL AREA (excluding WATER)	**19,070,466**	19,070,466	—	—	—	—
TOTAL ACREAGE under all CROPS and GRASS (*a*)	**4,821,249**	4,845,835	—	—	24,586	*0·5*
ARABLE LAND	**3,325,204**	3,348,568	—	—	23,364	*0·7*
PERMANENT GRASS (*a*) For Hay	**167,384**	172,055	—	—	4,691	*2·7*
PERMANENT GRASS (*a*) Not for Hay...	**1,328,681**	1,325,212	3,469	*0·3*	—	—
PERMANENT GRASS (*a*) TOTAL...	**1,496,045**	1,497,267	—	—	1,222	*0·1*
Wheat	**62,463**	63,506	—	—	1,043	*1·6*
Barley	**183,477**	164,262	19,215	*11·7*	—	—
Bere	**12,968**	9,355	3,613	*38·6*	—	—
Oats	**949,143**	963,498	—	—	14,355	*1·5*
Rye	**11,923**	6,046	5,877	*97·2*	—	—
Beans	**8,961**	10,379	—	—	1,418	*13·7*
Peas	**1,190**	1,009	181	*17·9*	—	—
Buckwheat	**436**	96	340	*354·2*	—	—
Potatoes	**149,710**	142,629	7,081	*5·0*	—	—
Turnips and Swedes	**439,185**	438,818	367	*0·1*	—	—
Mangolds	**2,930**	2,250	680	*30·2*	—	—
Cabbage	**5,363**	6,302	—	—	939	*14·9*
Kohl-Rabi	**72**	52	20	*38·5*	—	—
Rape	**6,947**	5,829	1,118	*19·2*	—	—
Vetches or Tares	**7,588**	7,807	—	—	219	*2·8*
Lucerne	**70**	17	53	*311·8*	—	—
Carrots	**611**	534	77	*14·4*	—	—
Onions...	**192**	191	1	*0·5*	—	—
Flax	**19**	3	16	*533·3*	—	—
Small Fruit	**7,148**	7,119	29	*0·4*	—	—
CLOVER and ROTATION GRASSES ... ... For Hay	**422,491**	437,333	—	—	14,842	*3·4*
CLOVER and ROTATION GRASSES ... ... Not for Hay...	**1,043,023**	1,073,698	—	—	30,675	*2·9*
CLOVER and ROTATION GRASSES ... ... TOTAL...	**1,465,514**	1,511,031	—	—	45,517	*3·0*
OTHER CROPS	**2,257**	2,196	61	*2·8*	—	—
BARE FALLOW	**7,037**	5,639	1,398	*24·8*	—	—
ORCHARDS (*b*)	**1,872**	2,011	—	—	139	*6·9*

(*a*) Excluding Mountain and Heath Land used for grazing (8,783,607 acres in 1912).
(*b*) Any Crop or Grass grown in Orchards is also returned under its proper heading.

LIVE STOCK.

DESCRIPTION.	1912.	1911.	INCREASE.		DECREASE.	
	No.	No.	No.	Per Cent.	No.	Cent.
Horses used for Agricultural purposes (includ. Mares for Breeding)	147,664	150,305	—	—	2,641	1·8
Unbroken horses (includ. Stallions) One year and above ...	32,042	32,840	—	—	798	2·4
Unbroken horses (includ. Stallions) Under one year	12,969	13,427	—	—	458	3·4
Other Horses	12,117	9,902	2,215	22·4	—	—
TOTAL OF HORSES	204,792	206,474	—	—	1,682	0·8
Cows and Heifers In Milk...	360	361,721	—	—	832	0·2
Cows and Heifers In Calf, but not in Milk	74,434	70,448	3,986	5·7	—	—
Other Cattle:—Two years & above	232,111	265,730	—	—	33,619	12·7
" " One year & under two	277,515	274,382	3,133	1·1	—	—
" " Under one year ...	233,987	227,736	6,251	2·7	—	—
TOTAL OF CATTLE	1,178,936	1,200,017	—	—	21,081	1·8
Ewes kept for breeding	2,992,856	2,973,413	19,443	0·7	—	—
Other Sheep:—One year & above	1,264,349	1,345,481	—	—	81,132	6·0
" " Under one year ...	2,734,472	2,845,448	—	—	110,976	3·9
TOTAL OF SHEEP	6,991,677	7,164,342	—	—	172,665	2·4
Sows kept for Breeding	20,418	22,206	—	—	1,788	8·1
Other Pigs	138,973	148,909	—	—	9,936	6·7
TOTAL OF PIGS...	159,391	171,115	—	—	11,724	6·9

Agricultural Conditions in November.

The Crop Reporters of the Board, in reporting on the crops and the agricultural conditions in England and Wales on December 1st, state that November, on the whole, proved rather unfavourable to autumn work, especially on heavy lands. Until the end of the month the weather was fairly mild, but there was generally a good deal of rain; in some districts this proved a serious hindrance, but in others good progress was made. At the end of the month the weather was much more inclement, and field work was to a large extent stopped. On the whole, autumn work is still rather behindhand, but progress has varied a good deal in different districts.

The Reporters estimate that rather more than 75 per cent. of the land to be devoted to wheat had been sown by the end of the month, this being considerably less than had been sown at the corresponding date in 1911. The appearance of the winter crops was quite satisfactory, particularly that sown early; that which went in late is more backward, and much of it is not yet above ground.

Mangolds had practically all been lifted and clamped in good condition. Their quality on the whole is good, but the roots are small in size, in consequence of which the yield of England and Wales is below the average, the recently published preliminary returns showing an average yield of 18·1 tons per acre, or 1¾ tons below the average, although 1¼ tons better than in 1911. The total production, on an area of 485,664 acres, amounts to 8,790,000 tons.

Similar remarks as to quality, condition, and production apply to turnips and swedes, which continued very generally to make growth during the month. Their total production is estimated at 12,888,000 tons, or just 12 tons from each of the 1,073,000 acres planted with these roots. Although 3 tons per acre more than last year, this is nearly 1¼ tons below the mean.

The total production of potatoes in England and Wales is estimated at nearly 2,244,000 tons, which represents, on an area of 463,000 acres, a yield of 4·85 tons per acre, the lowest since the returns of produce were first collected in 1884.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for November, 1912, issued by the International Institute of Agriculture, shows the production of the cereal crops this year from information received up to November 20th. The countries for which it is possible to give an approximate estimate of the production are as follows:—In *Europe:* Prussia, Belgium, Bulgaria, Denmark, Spain, France, England and Wales, Ireland, Kingdom of Hungary, Italy, Luxemburg, Norway, Netherlands, Roumania, Russia-in-Europe (63 governments), Switzerland; in *America:* Canada, United States; in *Asia:* India, Japan, Russia-in-Asia (10 governments); in *Africa:* Algeria, Egypt, Tunis.

Wheat.—The total production in all the above-mentioned countries is estimated at 403,788,000 qr., as compared with 379,613,000 qr. in 1911, or an increase of 6·4 per cent. The area under production is less than last year by 2·9 per cent.

Rye.—The estimated production in the above countries (excluding England and Wales, India, Japan, Egypt, and Tunis) amounts to 192,009,000 qr., against 157,190,000 qr. last year, the increase being equal to 22·2 per cent. A revised estimate for Russia-in-Europe places the production at 117,915,000 qr., which shows an increase of 6,674,000 qr. over the previous estimate. The area planted is practically the same as in 1911.

Barley.—The total production in all the countries (with the exception of India) is now estimated at 154,322,000 qr., against 145,958,000 qr. in 1911, the excess amounting to 5·7 per cent. The area harvested shows a reduction on last year of 0·8 per cent.

Oats.—The production in Russia-in-Europe is now estimated to be 99,672,000 qr., which is 6,060,000 qr. more than the previous figure. The total production in the countries named above (excluding Ireland, India, and Egypt) is estimated at 421,204,000 qr., as compared with 346,987,000 qr. in 1911, or an increase of 21·4 per cent. The area under production, however, is 1·5 per cent. below that of last year.

Maize.—The production in the countries specified (excluding Prussia, Belgium, Denmark, France, England and Wales, Ireland, Luxemburg, Norway, Netherlands, and India) is estimated to be 445,012,000 qr., which shows an excess of 21·8 per cent. over 1911, when the production was 365,478,000 qr. The estimate for the United States has undergone a large revision, the production now being placed at 369,626,000 qr., which is 17,861,000 qr. more than the estimate given last month. The area planted exceeds that of 1911 by 1·8 per cent.

The following supplementary notes are given:—

Austria.—The maize harvest was not terminated in some districts until the end of October. It has matured badly on some of the low grounds and has suffered a diminution in quality. On November 1st the condition of the harvest pointed to a production only slightly above the average.

Argentina.—The area sown with wheat in 1912–13 was 16,964,000 acres, as compared with 17,036,000 acres in 1911–12, with oats 2,939,000 acres, as compared with 2,547,000 acres, and with flax 4,310,000 acres, against 4,026,000 acres.

Australia.—The area sown with wheat in 1912–13 amounts to 7,692,000 acres, against 7,425,000 acres in 1911–12. On November 1st the condition of this cereal was average. The final figures of the production of the cereal crops in 1911–12 are as follows:—Wheat, 8,981,000 qr., as compared with 11,886,000 qr. in 1910–11; barley, 257,000 qr., against 278,000 qr.; oats, 1,195,000 qr., against 1,928,000 qr.; and maize, 1,039,000 qr., against 1,521,000 qr.

Uruguay.—The production of wheat in 1911–12 is given as 1,094,000 qr., as compared with 746,000 qr. in 1910–11.

Sugar Beet.—The estimated total production in Prussia, Belgium, Bulgaria, Denmark, Spain, Croatia and Slavonia, Italy, Roumania, Russia, Sweden, and Canada amounts to 32,695,000 tons, as compared with 24,536,000 tons in 1911, the increase being equal to 33 per cent. The production in Russia is estimated at 12,964,000 tons, an increase of 0·9 per cent. on last year, and in Canada at 182,000 tons, or 15·3 per cent. more than in 1911. In Austria the condition of the crop points to a good yield, while in Hungary the yield is said to be abundant as to quantity, but the quality is not so good as last year, the beets containing a smaller percentage of sugar.

Russia.—A report in the official *Commercial Gazette* of November 20th states that owing to unfavourable weather during the later part of the summer and in the autumn, the Russian potato crop is only about average in quantity, and not fully satisfactory with respect to quality. Owing to excess of damp in the autumn, the potatoes in most cases are watery, in part affected with rot, small, and with a low percentage of starch. In many places October frosts have considerably damaged them. In Poland, the most important potato growing region, which produces 30 per cent. of the Russian crop, the yield is only medium, but the quality is satisfactory.

The same source on November 16th gives the preliminary estimate of the yield of potatoes in the 63 governments of European Russia as 36,599,000 tons.

Prussia.—H.M. Consul at Berlin reports that the Prussian census of animals of December 1st, 1911, gives the number of horses (including those for military purposes) as 3,171,579; of cattle, 11,682,234; of sheep, 4,372,489; and of swine, 17,244,855.

Canada.—A report issued by the Census and Statistics Office at Ottawa, based upon returns made at the end of October, states that the total area planted with potatoes, turnips, mangolds, &c., hay and clover, alfalfa, fodder corn, and sugar-beets this year amounted to 8,732,000 acres, as compared with 9,160,000 acres in 1911, while the total value of the products is £39,569,000, against £46,001,000 last year. The decrease is caused by the diminution, both in area and yield, of the hay and clover crop, which is less than last year in area by 426,000 acres, and in yield by 2,000,000 tons. All the other crops show increases, except alfalfa, the area of which is relatively small. The yield of potatoes is 81,343,000 bush.; of turnips and other roots, 87,505,000 bush.; of fodder corn, 2,859,000 tons; of sugar-beets 204,000 tons; and of alfalfa, 310,000 tons. These crops are of good quality, but there are numerous reports of potatoes rotting after harvesting, owing to constant rains.

The area estimated to be sown with fall wheat in five provinces of Canada this season aggregates 1,086,000 acres, as compared with 1,157,000 acres last year. The condition of this crop on October 31st was 92·67 per cent. of the standard for the five provinces. It was above 90 in each province, except Manitoba, where the small area of about 4,000 acres had a percentage condition of 88½ per cent. The percentage of fall ploughing completed upon land intended for next year's crops ranges from 45 in Ontario, to 77 in Prince Edward Island, in the east, and from 24 in Alberta to 38 in British Columbia, in the west.

United States.—The Crop Reporting Board of the Department of Agriculture estimates the area sown with winter wheat this autumn as 32,387,000 acres, as compared with 33,215,000 acres in 1911, the reduction being equivalent to 2·5 per cent. The average condition of the crop on December 1st was 93·2, as compared with 86·6 in 1911. The area of rye is estimated at 2,443,000 acres, or 1·4 per cent. less than last year, when the acreage was 2,478,000, and the condition of the crop on December 1st as 93·5, as against 93·3 last year. (*Dornbusch*, December 9th, 1912.)

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on December 1st, 1912, certain diseases of animals existed in the countries specified:—

Austria (for the period November 13th—20th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 694 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period October 1st—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (1 "foyer" in 1 "commune"), Rabies.

Bulgaria (for the period September 14th—21st).

Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Swine Fever.

Denmark (month of October).

Anthrax, Swine Erysipelas.

France (month of October).
Anthrax, Blackleg, Foot-and-Mouth Disease (3,459 "étables" in 1,130 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period November 1st—15th).
Foot-and-Mouth Disease (83 infected places in 42 parishes), Glanders and Farcy, Swine Fever.

Holland (month of October).
Anthrax, Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (for the period October 30th—November 6th).
Anthrax, Foot-and-Mouth Disease (total of 26 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period October 28th—November 3rd).
Anthrax, Blackleg, Foot-and-Mouth Disease (218 new cases entailing 7,592 animals), Glanders and Farcy, Sheep-scab, Swine Fever.

Montenegro (for the period June 15th—July 1st).
Glanders and Farcy.

Norway (month of October).
Anthrax, Blackleg.

Rumania (for the period October 29th—November 5th).
Anthrax, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of July).
Anthrax, Foot-and-Mouth Disease (20,742 animals in 296 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period September 14th—21st).
Sheep-pox, Swine Fever.

Spain (month of September).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (2,765 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of October).
Anthrax, Blackleg, Swine Erysipelas.

Switzerland (for the period November 11th—17th).
Anthrax, Blackleg, Foot-and-Mouth Disease (165 "étables" and "pâturages" entailing 2,363 animals, of which 25 "étables" were declared infected during the period), Swine Fever.

Agricultural Labour in England during November.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in November:—

The weather during November was usually fine until the last week of the month, when some time was lost by labourers outside the regular farm staff through rain and snow. Apart from such interruption, these men were fairly well employed at such work as threshing, raising the root crops, potato-lifting, spreading manure, and repairing hedges. The demand for their services was generally met by the supply, though some scarcity of men was reported in a few districts, more particularly in the Midland Counties.

Northern Counties.—Extra labourers were in fairly regular employment until the end of the month, when unfavourable weather caused some loss of time. The supply of such men was generally about equal to the demand, though some scarcity was reported in parts of the Longtown (*Cumberland*) and Settle (*Yorkshire*) Rural Districts, while there was a surplus in the Patrington and Scarborough (*Yorkshire*) Rural Districts. An upward tendency in wages was reported at several of the hiring fairs for indoor farm servants, which were held during November in *Northumberland, Durham,* and *Yorkshire,* and a more pronounced advance in wages took place at the hirings in *Cumberland, Westmorland,* and *Lancashire,* in which counties a number of increases of from 10*s.* to £1 for the half-year were reported.

Midland Counties.—There was a fair demand for extra labourers in most districts, and an insufficient supply of men was again reported in several districts in these counties. Such districts in November included several parts of *Cheshire* and the Tamworth (*Staffordshire*), Oswestry (*Shropshire*), Pershore (*Worcestershire*), Monks Kirby (*Warwickshire*), Oundle and Wellingborough (*Northamptonshire*), Banbury (*Oxfordshire*), and Buntingford (*Hertfordshire*) Rural Districts; a surplus of men was reported in the Hayfield (*Derbyshire*), and Upton-on-Severn (*Worcestershire*) Rural Districts. More men for permanent situations were wanted in the Bucklow (*Cheshire*), Cannock (*Staffordshire*), Monks Kirby (*Warwickshire*), and Daventry, Oundle, and Wellingborough (*Northamptonshire*) Rural Districts.

Eastern Counties.—Threshing, raising the root crops, and other seasonal work provided a good deal of employment on most days in November for extra labourers in these counties. The supply of such men, while usually sufficient, was not equal to requirements in parts of the Brigg and Welton (*Lincolnshire*) and Downham and East and West Flegg (*Norfolk*) Rural Districts, and there was some scarcity of men for permanent situations in the Loddon and Clavering (*Norfolk*) Rural District.

Southern and South-Western Counties.—Reports from these counties state that extra labourers were generally employed on such work as threshing, raising, and storing roots, lifting potatoes, hedging, ditching, and manure carting. They were in excess of the demand in parts of the Farnham (*Surrey*), Hartley Wintney and Andover (*Hampshire*), Cricklade-and-Wootton Bassett (*Wiltshire*), and Wareham-and-Purbeck (*Dorset*) Rural Districts, while more could have been employed, if available, in the Bridge and Isle of Thanet (*Kent*), Rye (*Sussex*), and Chard (*Somerset*) Rural Districts. Men for permanent situations were reported to be somewhat scarce in the Blean (*Kent*), Petworth (*Sussex*), Chippenham (*Wiltshire*), Dursley, Northleach, and Stow-on-the-Wold (*Gloucestershire*), Kingsbridge, and Newton Abbot (*Devonshire*), and West Penwith (*Cornwall*) Rural Districts.

THE CORN MARKETS IN NOVEMBER.

C. KAINS-JACKSON.

Wheat.—The traditional dullness of November markets has characterised those of the month this year, but this is only true of the transactions for immediate delivery. No records of sales for forward supply of Colonial and foreign wheat are available, and even if they were officially chronicled it would be impossible to say in advance whether the purchaser would take actual delivery when the time came or would prefer to commute that obligation for a money payment. Report has it that during November considerable quantities of the new wheat crops of Australia and Argentina were placed for January and February shipment, but it is impossible to put the quantities arranged for at any specific total. What, however, can be done is to note the prices accepted for such shipments, as they afford a useful suggestion as to what currencies are likely to rule in the early months of 1913. Australian wheat closely resembles English in average selling value, and while Argentine has a greater range of quality, it may, speaking roughly, be regarded as worth a full price for good English, but not more. The price paid for early 1913 shipment of Australian has been 37*s.*, while 35*s.* has been taken for Argentine. Even the cheaper of the two will be seen by no means to undersell British wheat, which at the end of November ranged from a little under 30*s.* in Yorkshire and Lincolnshire, to about 34*s.* in Essex, Suffolk, and Norfolk. One notes that Argentina is in a greater hurry than Australia to sell its new crop. November business in American wheat has been rather poor, but the fine spring wheat tendered by Duluth at 7*s.* 6*d.* per cental has found favour. The difficulty of the American market this season is that later wheat, that is to say, the spring sown, is going into consumption and exportation out of its due order, and before the stocks of the earlier reaped winter wheat have been substantially reduced. An anomalous state of the American markets is likely to result as the cereal year advances, if this tendency be not altered, and there is some apprehension among wheat holders in Great Britain that America may in January or February lower the price of winter wheat so as specially to tempt purchasers of that kind. At present no such tendency to push matters is discernible; 7*s.* 5*d.* per cental was asked at the close of November for average red winter from the United States. Canadian new wheat was hardly quotable on November 1st, the supply on spot being so inadequate. On the 30th offers were sufficiently liberal to allow of No. 1 being regularly quoted at 7*s.* 9*d.* per cental, No. 2 at 7*s.* 5*d.*, No. 3 at 7*s.* 3*d.*, No 5 at 6*s.* 5*d.*, and No. 6 at 6*s.* per cental. It will be seen that the British buyer makes rather remarkable price distinctions, the gap between No. 1 and No. 2 is much more than that between No. 2 and No. 3. These differences do not argue a like quality divergency so much as a better or slacker demand for the particular kind for mixing purposes. While the careful division by the Canadian authorities of wheat for export into six grades is doing much to stimulate inquiry and promote sales in Great Britain, a new difficulty is created in the matter of obtaining equal shipments of the kinds according to the British demand for this or that grade. Indian wheat in November was a steady but slow sale at about 39*s.* per qr. for white, and 38*s.* 6*d.* for red. Australian of the old crop was dear, on account of spot scarcity. Few holders would let anything go under 42*s.* per qr. The month's shipments were 2,548,000 qr. from North America, 675,000 qr. from South America, 2,460,000 qr. from Russia, 701,000 qr. from India, and 150,000 qr. from Australasia. The North American shipments were more than double those of November, 1911, and Russian exports also showed a great increase on the year. Despite these heavy shipments the supply on passage on 30th was only 2,495,000 qr., as compared with 2,680,000 qr. a year previously. Continental demand was above the average, and the month's arrivals were considerable. The stocks in fifteen leading ports at the end of the month were 2,055,000 qr., against 2,305,000 qr. a year back. The situation, therefore, was not discouraging to spot holders, though returns of the world's wheat production, as published by the International Institute of Agriculture, constituted a warning that very large surpluses existed, and in the ordinary course of events would in 1913 be steadily "unloaded." At the same time, it has to be remembered that comparatively little wheat is speculatively consigned to this country.

Flour.—This staple has pursued a very quiet way for some weeks past, but the sharp frost with which November closed induced an increased retail inquiry. Pillsbury's Best came on sale at 29*s.*, Duluth at 28*s.* 6*d.*, and the finer sorts of Canadian came down a little in order to compete with these offerings from the southern side of the Great Lakes. The total shipments from North America were 696,000 sacks, which is a good but not an extravagant total. There are now 240,000 sacks on passage. The month closed with Household Flour at Mark Lane obtainable at 28*s.* cash ex mill, 33*s.* being paid for best London, and 38*s.* for Hungarian.

Barley.—There has been an increased sale of British barley, and yet prices have declined during the month. The explanation has been that large quantities of secondary and stained or weathered but fairly robust and heavy corn have been put on the market, and a very moderate price accepted in order to effect a clearance. At exchanges like Hull, Norwich, and Peterborough, where the inferior condition of offerings has been marked, averages have fallen below 30*s.* In Kent, and also in Shropshire, some rather good barley has come to market, and better mean values have been recorded. Imported barley has been firm where malting quality was attained, but much cheaper where feeding grade was in question. The month's closing prices were 42*s.* for Californian, 44*s.* for Ouchak, 28*s.* for Indian, and 26*s.* for Russian. The shipments from Russia were extremely heavy, 2,817,000 qr., and dwarfed alike the 235,000 qr. of India and the 213,000 qr. of the United States. At the close of the month over 900,000 qr. were on passage.

Oats.—The English averages have kept up rather well, and at Mark Lane some excellent prices have been made for the heavier samples. One may note 25*s.* for fine White Gartons, 23*s.* 6*d.* for good Black Tartary, and about the same price for Grey Winter. Badly weathered oats have predominated at some markets, especially in the fen country. These have sometimes been sold at as low a price as 15*s.*

per qr. Imported oats have made 26*s*. for New Zealand, and 24*s*. for Chilian, but 21*s*. has been accepted for Canadian, 20*s*. for American, and 19*s*. for La Plata. Russia, while sending the usual poor Baltic corn at 19*s*. per 304 lb., has been exporting more fine samples than usual. Choice 328 lb. oats have been on sale at 27*s*., good 320 lb. at 25*s*. per qr. The month's shipments were 884,000 qr. from North America, 140,000 qr. from South America, 1,091,000 qr. from Russia. There were on the 30th 280,000 qr. on passage.

Maize.—In August Argentina, with 3,509,000 qr. exported, achieved a record total of shipments. This in November was not surpassed, but 3,415,000 qr. was an almost equally surprising quantity, and the trade of the month closed with prices showing a marked decline. About 25*s*. was accepted for Argentine to hand, and 24*s*. for the grain due in December. America offered to ship new maize in February at 22*s*. per 480 lb., which was 3*s*. below the first speculative offers in October. Other shipments of November beside the Argentine were 112,000 qr. from Russia, and 40,000 qr. from Roumania. The round maize from these countries is held for about 27*s*. per qr. On the 30th there were 1,655,000 qr. on passage, which is, of course, an exceptionally heavy total. Over 80 per cent. of it was Argentine.

Oilseeds.—The shipments of linseed were only 103,000 qr. from India and 221,000 qr. from Argentina, and only 99,000 qr. altogether were on passage on the last day of the month. Yet the market was completely in buyers' favour, large contracts to ship from the United States in January, and from Canada in February, depressing value, and the speculative offers of La Plata to ship her new crop at a low price completing the discomfiture of the spot holder. Prices closed at 50*s*. for Indian, 48*s*. for La Plata, off stands, and at 49*s*. for Indian, 47*s*. for La Plata, 48*s*. for North American, and 52*s*. for fine Russian, January delivery. Linseed cake has fallen in sympathy with linseed, and this has been of advantage to those with live stock to fatten. London-made closed at 8*s*. 9*d*. per cwt., Russian at 8*s*. 6*d*. Cottonseed in November was a quiet market, but £8 12*s*. 6*d*. per ton was usually obtainable, and this is not a depressed price.

Various.—There has been a slight rally in beet sugar, but it is still very cheap. The colder weather increased the sales of oatmeal, and two guineas was the price made for good Midlothian per 280 lb. Indian muttor (medium small pulse) came on sale at 28*s*. per 480 lb., and was regarded as good value thereat. Some excellent maple peas from New Zealand made 40*s*. per qr. Chinese beans realised 31*s*. per qr. Rye fell 1*s*. during the month, and was obtainable for 30*s*. per qr. Articles for which there was some demand were tares at 72*s*. per qr., and dried grains at about five guineas per ton. There was towards the end of the month an improved inquiry for barley meal, the mean price of which was about 18*s*. per 240 lb. sack.

THE LIVE AND DEAD MEAT TRADE IN NOVEMBER.

A. T. MATTHEWS.

Fat Cattle.—The grazing season of 1912 has been a good one, and has formed a sharp contrast to that of last year. It is seldom that grass-fed cattle have maintained their condition up to the end of November so well as they have done in the season now closing. The supplies at the Islington Market have been entirely from the pastures up till the last Monday of the month, when there were a few stall-feds from Norfolk. The abnormal position of October as regards supplies has been continued, and there have been great gaps in those markets where Irish stock are usually in evidence. Another striking feature has been the almost total absence of Polled Scots in the southern markets, and in London there have been scarcely any worth quoting. Prices have been firm on the whole. Fluctuations in various markets have balanced each other, so that averages have been very slightly affected, though, when we compare the prices obtained in various districts, we find a difference which is almost startling. It is by no means uncommon at this time of year for Shorthorns to be quoted at 1*s.* per 14 lb. more at Ipswich than at Bristol, but in the last week the difference was 1*s.* 6*d.*, or over 1*d.* per lb. This was, of course, owing to the superior finish and quality of the stall-fed bullocks.

The November averages for the various breeds were as follows:—Shorthorns, 8*s.* 7*d.* and 7*s.* 9*d.* for first and second quality, against 8*s.* 6d. and 7*s.* 8*d.* in October; Herefords, 8*s.* 8*d.* and 8*s.* 1*d.*, against 8*s.* 8*d.* and 7*s.* 11*d.*; Devons, 8*s.* 6*d.* and 7*s.* 10*d.*, against 8*s.* 6*d.* and 7*s.* 9*d.*; Welsh Runts, 8*s.* 4*d.* and 7*s.* 9*d.*, against 8*s.* 4*d.* and 7*s.* 8*d.*; and Polled Scots, 8*s.* 10*d.* and 8*s.* 2*d.*, against 8*s.* 10*d.* and 8*s.* 4*d.* per 14 lb. stone.

Veal Calves.—The business in veal becomes more restricted as winter approaches, but supplies have not been excessive, and the demand has been sufficient to maintain October prices, the averages being 8½*d.* and 7¾*d.* per lb. for first and second quality in eighteen British markets.

Fat Sheep.—In most of the larger English markets, supplies have been considerably below the average, owing, in a great measure, to the absence of Irish, but as the dead-meat markets have been amply supplied, prices have been prevented from advancing to any appreciable extent. Still, there was a hardening tendency in values, especially for the choicer sorts, and in the third week there was a distinct advance of ¼*d.* per lb. in the averages, and Downs of first quality (including prime small shearlings, as well as tegs) averaged 8¾*d.* per lb. In the last two weeks prime Hampshire tegs have easily made 9½*d.* per lb. at Islington, while 9*d.* and 9¼*d.* have been touched at other markets. The late advance, however, was not sufficient to affect the monthly averages, which read the same as in October for first quality Downs and Longwools. For the whole month in about twenty-two leading English markets Downs averaged 8¾*d.*, 7¾*d.*, and

6d. for the three qualities, and Longwools 8¾*d.*, 7¼*d.*, and 5¾*d.* per lb. First quality Cheviots and Cross-breds in Scotland are now making over 9*d.* per lb., and scarcely any sheep of these breeds have been on offer at the Metropolitan Market.

With the known reduction in the total number of sheep in the country, and fair prospects of winter keep, supplies are likely to continue light, with at least some advance in average values.

Fat Pigs.—For many months bacon pigs have steadily moved upwards in value, and the averages in over thirty British markets in November were 8s. per 14 lb. stone for prime small, and 7*s.* 4*d.* for heavier pigs. In the last week the very high price of 9*s.* was recorded at Penrith, and 8*s.* 8*d.* at Salford.

Carcass Beef—British.—In the London dead-meat market both supplies and prices of fresh-killed beef have changed very slightly. The large consignments from Ireland have prevented any advance, and a good deal of the Irish beef has been sold below the nominal quotations. Considerable criticism has been passed on the condition of the Irish offerings, as regards dressing and packing, some of them being badly bruised. Scotch short sides averaged 4*s.* 11*d.* and 4*s.* 7*d.*, and long sides 4*s.* 5*d.* and 4*s.* 2*d.*; English, 3*s.* 10*d.* and 3*s.* 8*d.* per 8 lb. stone, while Irish has been quoted at 3*s.* 7*d.* and 3*s.* 5*d.* The lower grades, however, have realised no more than chilled.

Chilled Beef.—It is very unusual for the price of foreign beef to be depreciated in value by the competition of home-killed of low quality, but this has been the case during the last few weeks. Moderate arrivals from Argentina and some falling off in Irish have strengthened the market in the last fortnight, but chilled hindquarters only averaged 3*s.* per stone for first, and 2*s.* 7*d.* for second quality, a decline of 3*d.* on October prices. Forequarters, however, maintained their average at 2*s.* 3*d.* and 2*s.* per stone.

Frozen Beef.—A very quiet trade at rather lower prices has prevailed for "hard" beef. Hindquarters have averaged about 2*s.* 5*d.* and 2*s.* 2*d.* per stone.

Carcass Mutton—Fresh-Killed.—There was a more cheerful trade in British mutton, and prices steadily advanced. Scotch averaged 5*s.* 1*d.* and 4*s.* 8*d.* for first and second quality; English, 4*s.* 7*d.* and 4*s.* 3*d.*; Dutch, 4*s.* 2*d.* and 3*s.* 11*d.* per stone; and Irish similar prices to Dutch. Very small Scotch "hill" tegs have lately been selling up to 5*s.* 8*d.*, but prime Cheviot wethers of 7½ stones were cheap, only being worth 4*s.* 8*d.* per 8 lb. There has therefore been a considerable difference in the quotations for first and second quality.

Frozen Mutton and Lamb.—Frozen mutton was a quiet, steady trade, and average prices were only very little lower than in October. New Zealand made 3*s.* and 2*s.* 10*d.*, and Argentine 2*s.* 8*d.* and 2*s.* 6*d.* per stone. New Zealand lamb of best quality made a trifle more money, but second quality slightly declined, averages being 3*s.* 11*d.* and 3*s.* 7*d.* A moderate quantity of Argentine lamb made 3*s.* 4*d.* to 3*s.* 7*d.* per stone on average.

Veal.—Prime carcasses, after the first week, became scarce and dear. British averaged 5*s.* 6*d.* for first, and 5*s.* for second quality in the London market. The best Dutch fetched 6*s.* per stone.

Pork.—There has been a very good trade for pork, but prices varied to the extent of 4*d.* per stone from week to week, according to supplies, 5*s.* 4*d.* being the maximum for small sizes. In Smithfield Market English pigs averaged 5*s.* 2*d.* and 4*s.* 10*d.* per stone.

THE PROVISION TRADE IN NOVEMBER.

HEDLEY STEVENS.

Bacon.—The reduction in prices reported last month has continued, and for some cuts, notably long sides, the reduction on the month is from 3*s.* to 5*s.* per cwt. The arrivals from the Continent were heavier, especially from Russia, and with free offerings from Ireland at lower prices, the trade has been mostly in long sides. American meats have been proportionately dear, but with the very small arrivals from that country prices do not show much depreciation, and as regards American and Canadian hams, these show an advance of several shillings per cwt., owing to scarcity of stock and dealers securing hams for their Christmas trade.

All advices from the United States of America point to high prices during the winter, on account of the large home demand for hog products in consequence of the abnormally high prices of beef and the anticipated reduction in the number of hogs to be marketed during that period. The mortality amongst hogs in the United States is reported to have been very severe during the year, and it is thought that the receipts during this winter will show a falling off of at least 25 per cent., compared with last winter, but during the summer months the result of the large crop of corn may possibly be felt, and the marketing of the raw material much increased, resulting in lower prices for bacon. The stock of cut meats (hog products) in the principal markets of the United States of America at the end of October showed a falling off of 45 million pounds in comparison with last year, the figures being 102½ million pounds in October of this year, compared with 147½ million pounds in 1911.

At the annual Packers' Convention, held in Chicago on October 14th, attention was directed to the fact that within the last ten years the population of the United States had increased by 16,000,000, while live stock had decreased by 20,000,000. Until these conditions alter a material reduction of prices or an increased surplus for export can hardly be expected. The prices of hogs marketed at Chicago during the month ranged from $7.15 to $8.10, against $5.50 to $6.55 at the same time last year, and $6.60 to $8.10 two years ago.

English curers have found that pigs were offered more freely during November, and prices are a little easier, but with cheaper feeding stuffs this should not deter breeders from increasing their holdings, as prices are not likely to decline seriously.

Cheese.—During the whole of the month the demand for Canadian cheese has been very small, but there has not been much change in spot prices, although cabled figures have been easier. English dealers are very timid as to the prices likely to prevail during the winter months, knowing that the regular arrivals from New Zealand will be much larger than in previous seasons, and so cause values for cheese of all descriptions to recede rather than advance. At present spot values importers stand to lose heavily on their c.i.f. purchases of Canadians made in September and October. Stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 365,000 boxes, against 314,000 boxes at the end of November, 1911, and 428,000 boxes in 1910.

There has been a fair demand for English cheese, prices being comparatively low against Canadian.

The Montreal Trade Bulletin, dated November 15th, says:—"As navigation is now close at hand it should be possible to arrive at an approximate estimate as to the quantity of cheese to go forward on export account, from now until the first of May, 1913. We know that to the close of last week, November 9th, the exports from Montreal, Quebec, and Portland were 1,614,288 boxes. On the same date the stocks in cold storage and in factorymen's hands were placed at 35,000 boxes at points west of Toronto, and at 150,000 boxes east of Toronto, to which may be added 175,000 boxes as estimated by us last week, making a total of 360,000 boxes. In view of the rapidly increasing consumption of cheese in the north-west, it is safe to calculate 50,000 boxes for the requirements of all Canada, which will leave 310,000 boxes for export. This quantity is considered a conservative estimate by some of the best posted men in the trade. And considering that prices are 1¼ cents per lb. lower than last year at this time, holders are by no means downcast over the future."

Butter.—The markets for butter have been very irregular, and with lower prices quoted for all descriptions, buyers have operated from hand to mouth. Any trade passing has been in the best fresh lots, the mild weather doubtless spoiling the demand for stored parcels. The shipments from Australia have been smaller than anticipated, but with reports of recent good rains, the shipments should soon show an increase. On the month prices for Colonial show a reduction of from 4*s*. to 6*s*. per cwt., or from 14*s*. to 18*s*. below the same time last year, when they ranged from 124*s*. to 130*s*. for best descriptions.

Prices in Canada and the United States show little change in the month, best goods in the latter country realising equal to 142*s*. to 145*s*. delivered in this country.

The make of Irish butter during November was unusually large, and although prices were reduced, buyers were difficult to find for this description.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of November, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	ENGLAND.		SCOTLAND.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	8 10	8 2	45 6	41 1
Herefords	8 8	8 1	—	—
Shorthorns	8 7	7 9	44 7	40 3
Devons	8 6	7 10	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	8¾	7¾	10	7
Sheep:—				
Downs	8¾	7¾	—	—
Longwools	8¼	7¼	—	—
Cheviots	9	8	9	7¾
Blackfaced	8½	7¾	8	7
Cross-breds	8½	7¾	9	7¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Bacon Pigs	8 1	7 7	7 6	6 6
Porkers	8 5	7 11	7 11	6 11
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	24 1	19 17	26 5	21 7
,, —Calvers... ...	22 17	19 15	22 7	20 5
Other Breeds—In Milk ...	20 9	16 1	22 16	18 4
,, —Calvers ...	18 10	16 5	23 9	19 9
Calves for Rearing	2 5	1 15	2 15	2 0
Store Cattle:—				
Shorthorns—Yearlings ...	11 7	9 9	13 10	11 1
,, —Two-year-olds...	15 9	13 10	19 1	15 16
,, —Three-year-olds	19 0	17 0	24 10	19 0
Polled Scots—Two-year-olds	—	—	20 19	16 2
Herefords— ,,	14 19	13 3	—	—
Devons— ,,	13 17	12 0	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Downs or Longwools ...	38 3	32 1	—	—
Scotch Cross-breds ...	—	—	31 7	26 7
Store Pigs:—				
8 to 10 weeks old	18 4	14 3	19 9	16 4
12 to 16 weeks old	29 6	22 1	—	—

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of November, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Liverpool.		London.		Manchester.		Edinburgh.		Glasgow.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
BEEF:—													
English	1st	51	6	48	0	53	6	47	0	61	6*	67	6*
	2nd	46	6	42	0	51	6	45	0	56	0*	56	0*
Cow and Bull ...	1st	45	0	42	0	42	0	42	0	46	6	44	6
	2nd	41	6	37	6	39	6	37	6	38	6	35	6
Irish:—													
Port Killed ...	1st	48	6	47	0	50	6	45	6	52	6	51	6
	2nd	44	0	42	0	47	6	42	0	45	0	45	0
Argentine Frozen—													
Hind Quarters...	1st	34	0	32	6	33	6	32	6	34	6	33	0
Fore ,, ...	1st	27	0	25	0	26	0	25	6	27	6	27	6
Argentine Chilled—													
Hind Quarters...	1st	42	6	39	0	41	6	40	0	43	0	40	0
Fore ,, ...	1st	30	6	26	0	31	0	27	0	32	0	30	6
Australian Frozen—													
Hind Quarters...	1st	32	0	32	6	32	6	34	0	—		32	0
Fore ,, ...	1st	26	6	24	0	25	6	24	0	—		26	6
VEAL:—													
British	1st	—		76	6	77	0	77	6	—		70	0
	2nd	63	0	67	6	70	0	73	0	—		65	6
Foreign	1st	—		—		81	6	—		77	0	70	0
MUTTON:—													
Scotch	1st	—		69	0	71	6	69	0	63	0	70	0
	2nd	—		63	0	66	0	65	6	53	6	50	0
English	1st	63	0	62	6	64	0	64	6	—		—	
	2nd	57	0	56	6	59	6	61	0	—		—	
Argentine Frozen ...	1st	38	6	36	6	38	0	37	6	39	6	37	6
Australian ,, ...	1st	37	0	35	6	38	6	35	6	—		36	0
New Zealand ,, ...	1st	—		—		42	6	—		—		—	
LAMB:—													
New Zealand ...	1st	56	0	53	6	55	0	53	6	—		51	6
Australian	1st	48	6	45	0	—		45	0	—		46	0
Argentine	1st	46	0	44	6	50	6	44	6	—		46	0
PORK:—													
British	1st	70	0	74	6	72	6	73	6	67	0	64	0
	2nd	65	6	65	6	67	6	69	6	57	0	59	6
Foreign	1st	—		—		69	0	—		—		—	

* Scotch.

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6 ...	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
„ 13 ...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
„ 20 ...	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
„ 27 ...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3 ...	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
„ 10 ...	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
„ 17 ...	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
„ 24 ...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2 ...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
„ 9 ...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
„ 16 ...	32	6	30	1	34	0	23	6	24	11	31	2	18	0	17	6	21	8
„ 23 ...	32	9	30	2	34	1	23	7	25	0	31	10	17	11	17	5	21	9
„ 30 ...	33	0	30	3	34	4	23	8	24	11	30	3	18	0	17	5	21	8
Apl. 6 ...	33	6	30	4	34	10	23	1	24	7	30	9	17	11	17	7	21	11
„ 13 ...	33	7	30	3	35	4	23	5	25	2	30	2	18	3	18	3	22	1
„ 20 ...	33	7	30	4	36	7	23	0	25	5	29	11	18	3	17	10	22	4
„ 27 ...	33	0	30	11	37	10	22	10	25	5	30	4	18	3	18	3	22	9
May 4 ...	32	6	31	4	38	1	22	7	25	7	30	2	18	2	18	6	23	1
„ 11 ...	32	1	31	8	37	11	22	0	25	1	31	1	18	1	19	0	23	7
„ 18 ...	31	10	32	6	37	8	21	8	25	4	31	2	17	8	19	2	23	7
„ 25 ...	31	3	32	8	37	2	21	4	25	0	31	1	17	10	19	5	23	7
June 1 ...	30	2	32	5	36	10	21	8	24	10	30	0	17	10	19	5	23	9
„ 8 ...	29	1	32	4	36	11	20	9	25	7	29	11	17	10	19	7	24	0
„ 15 ...	29	0	32	3	37	0	18	11	23	11	30	8	18	0	19	8	23	10
„ 22 ...	29	4	31	11	37	5	20	1	23	9	30	8	17	9	19	10	24	0
„ 29 ...	29	9	31	10	37	10	19	11	24	5	30	2	17	7	19	9	23	11
July 6 ...	30	4	32	1	38	2	19	5	25	10	31	7	17	4	19	9	23	11
„ 13 ...	31	1	32	3	38	3	21	3	25	10	30	2	17	7	19	11	24	1
„ 20 ...	31	11	32	5	38	10	19	9	24	3	30	9	17	5	19	5	24	8
„ 27 ...	33	5	32	5	38	9	20	10	23	8	30	9	18	1	19	7	23	4
Aug. 3 ...	33	9	32	0	38	4	20	5	24	4	28	6	18	3	18	2	22	2
„ 10 ...	33	5	31	6	39	2	20	4	26	9	30	7	18	0	18	0	22	4
„ 17 ...	32	11	31	6	38	2	20	11	27	8	28	3	17	11	17	10	21	8
„ 24 ...	32	7	31	8	35	6	20	10	28	10	28	1	17	2	18	0	20	10
„ 31 ...	32	2	31	7	34	10	22	10	28	4	28	6	17	2	18	3	20	8
Sept. 7 ...	31	11	31	10	35	1	23	3	28	4	29	9	17	2	18	1	21	8
„ 14 ...	30	11	32	0	33	5	24	3	29	0	29	0	16	6	18	5	20	5
„ 21 ...	30	2	32	4	32	7	24	2	29	11	29	6	16	3	18	9	19	10
„ 28 ...	30	1	32	6	31	7	24	4	30	5	29	9	16	4	19	1	19	5
Oct. 5 ...	30	1	32	7	31	8	24	7	30	9	29	7	16	3	19	5	19	8
„ 12 ...	30	2	32	9	31	10	25	1	31	0	30	4	16	2	19	10	19	5
„ 19 ...	30	4	32	9	32	2	25	3	31	5	30	11	16	1	19	11	19	9
„ 26 ...	30	4	33	1	33	1	25	4	31	7	31	6	16	2	20	6	19	10
Nov. 2 ...	30	4	33	4	33	4	25	6	31	10	31	10	16	2	20	8	20	1
„ 9 ...	29	11	33	4	33	1	25	4	32	7	31	11	15	11	20	11	19	11
„ 16 ...	29	8	33	1	32	10	25	1	32	10	31	2	16	1	21	0	19	9
„ 23 ...	29	11	33	0	32	1	24	10	33	5	30	11	16	4	20	10	19	11
„ 30 ...	30	6	32	10	31	9	24	7	33	10	30	8	16	7	20	11	19	8
Dec. 7 ...	30	9	32	9	31	0	24	3	34	0	29	11	16	9	20	9	19	6
„ 14 ...	30	7	32	11			23	9	33	5			16	10	20	9		
„ 21 ...	30	7	32	9			23	10	33	5			16	9	20	8		
„ 28 ...	30	5	33	0			23	9	33	4			16	9	20	7		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1911.	1912.	1911.	1912.	1911.	1912.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	October	43 0	46 6	27 7	30 0	21 11	23 6
	November	43 3	47 1	27 11	30 5	22 2	24 1
Paris:	October	43 7	48 7	26 10	30 10	22 8	24 7
	November	43 9	49 1	27 3	31 5	22 11	24 9
Belgium:	September	34 2	35 7	26 7	30 0	22 3	25 7
	October	34 1	35 8	27 7	30 10	22 4	25 2
Germany:	September	43 4	43 4	33 4	32 9	24 4	24 0
	October	43 3	43 6	34 4	34 3	25 0	24 3
Berlin:	September	44 2	45 11	—	—	25 4	25 2
	October	43 10	45 4	—	—	25 7	26 0
Breslau:	September	40 10	39 10	30 8* 24 9†	31 10* 28 11†	23 2	27 3
	October	40 4	40 8	30 10* 25 1†	32 5* 28 10†	23 7	27 8

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of November, 1911 and 1912.

—	WHEAT.		BARLEY.		OATS.	
	1911.	1912.	1911.	1912.	1911.	1912.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London	34 4	34 6	34 7	31 8	21 8	21 11
Norwich	32 11	34 1	33 3	29 5	21 0	19 11
Peterborough	32 8	29 11	32 2	29 9	20 11	18 7
Lincoln...	33 2	30 9	32 5	31 10	21 6	20 2
Doncaster	32 11	30 11	31 9	31 4	21 1	19 11
Salisbury	32 3	33 0	32 3	32 2	20 9	20 4

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of November, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	15 0	14 0	—	—	15 3	13 6	16 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	123 6	119 6	122 0	119 0	121 0	117 6	122 0	—
,, Factory ...	107 6	99 0	105 0	95 0	106 0	100 0	—	—
Danish ...	—	—	131 0	127 6	130 6	127 6	127 0	—
French ...	—	—	—	—	122 0	118 0	—	—
Russian ...	113 6	107 6	109 6	104 6	113 0	111 0	—	—
Australian ...	117 0	113 6	116 6	113 0	118 6	116 0	112 0	—
New Zealand	121 0	118 0	119 0	116 0	118 0	115 0	117 0	—
Argentine ...	116 6	114 0	115 6	114 6	116 0	114 0	112 0	—
CHEESE:—								
British—								
Cheddar ...	76 0	72 0	74 0	72 0	76 0	72 0	70 0	68 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	75 0	70 0	81 6	78 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	65 6	63 0	65 0	62 0	64 6	63 6	64 6	—
BACON:—								
Irish	76 6	71 0	71 6	67 6	72 0	70 0	75 6	—
Canadian ...	71 0	68 6	68 6	67 0	69 0	67 0	69 0	67 0
HAMS:—								
Cumberland ...	—	—	—	—	110 0	102 6	—	—
Irish	—	—	—	—	112 0	101 6	93 0	91 0
American (long cut)	68 6	66 0	67 6	64 6	72 0	70 0	66 6	—
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	—	—	—	—	20 0	18 4	19 2	—
Irish	15 0	14 3	14 1	12 9	16 3	14 9	15 6	14 0
Danish ...	—	—	14 4	12 11	16 6	15 3	15 6	14 4
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
Edward VII.	92 6	82 6	73 6	66 6	95 0	85 0	—	—
Langworthy...	98 6	93 6	95 0	90 0	100 0	91 0	70 0	65 0
Up-to-Date ...	87 6	76 6	70 0	63 6	92 6	81 6	62 6	57 6
HAY:—								
Clover ...	110 0	90 0	119 6	97 6	130 0	103 0	80 0	75 0
Meadow ...	100 0	80 0	—	—	119 6	97 0	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1912.	1911.	1912.	1911.
Anthrax:—				
Outbreaks	62	106	701	829
Animals attacked	73	139	794	1,034
Foot-and-Mouth Disease:—				
Outbreaks	—	—	82	18
Animals attacked	—	—	636	467
Glanders (including Farcy):—				
Outbreaks	18	20	166	197
Animals attacked	34	58	307	477
Parasitic Mange:—				
Outbreaks	143	—	2,623	—
Animals attacked	229	—	5,543	—
Sheep-Scab:—				
Outbreaks	76	42	262	358
Swine-Fever:—				
Outbreaks	249	196	2,728	2,277
Swine Slaughtered as diseased or exposed to infection ...	3,815	2,918	37,312	27,733

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1912.	1911.	1912.	1911.
Anthrax:—				9
Outbreaks	—	2	3	16
Animals attacked	—	2	3	
Foot-and-Mouth Disease:—				
Outbreaks	3	—	68	—
Animals attacked	20	—	380	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	3
Parasitic Mange:—				
Outbreaks	2	1	60	54
Sheep-Scab:—				
Outbreaks	52	28	338	309
Swine-Fever:—				
Outbreaks	10	35	204	148
Swine Slaughtered as diseased or exposed to infection ...	54	424	1,635	2,347

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

Beiträge zur Kenntnis der niederen pflanzlichen Organismen besonders der Bakterien, von Hoch- und Niederungsmooren im floristischer, morphologischer und physiologischer Beziehung, *G. A. Ritter.* (Centbl. Bakt. (etc.), 2e Abt., Bd. 34. No. 23/25. 1912.) [63.115; 63.142.]

Memoire sur l'Assimilation de l'Acide Phosphorique par les Plantes, *A. Müntz* et *H. Gaudechon.* (Ann. Sci. Agron., September, 1912.) [63.161; 63.1672.]

Studies on Soil Physics. Part II.—The Permeability of an ideal soil to air and water, *Heber Green* and *G. A. Ampt.* [63.11(04).] The Estimation of Potassium, especially in fertilisers, soil extracts and plant ashes, *W. A. Davis.* [543.] Investigations on "Sickness" in soil. I.—Sewage "Sickness," *E. J. Russell* and *J. Golding.* [63.11(04).] Investigations on "Sickness" in soil. II.—"Sickness" in glasshouse soils, *E. J. Russell* and *F. R. Petherbridge.* [63.11(04).] (Jour. Agr. Sci., October, 1912.)

Contributions to our Knowledge of Soil-Fertility. III.—Bacterial Slimes in Soil. IV.—The Agricere and Bacteriotoxins of Soil, *P. Greig-Smith.* (Proc. Linn. Soc. N.S.W., 1911, Part 4.) [63.113; 63.115.]

Plant Diseases—

Le *Lophodermium Nervisequum*; Parasite des Aiguilles de Sapin, *Emile Mer.* (Rev. Eaux et Forêts, 15 Août, 1912.) [63.24.]

Beiträge zur Kenntnis der sogenannten Septoria-Krankheit der Fichte, *Rudolph* (Naturw. Ztschr. Forst. u. Landw., August, 1912. [63.24–49.]

Der Milchglanz der Obstbaüme, *H. T. Güssow.* [63.24–41.] Biochemische Untersuchungen über die Blattrollkrankheit der Kartoffel. IV.—Einige Bemerkungen über die Physiologie kranker knollen, *G. Doby.* [63.24–33.] (Ztschr. Pflanzenkrank., Bd. XXII., Heft 7, 1912.)

The Aphides attacking *Ribes*, with descriptions of Two New Species, *F. V. Theobald.* (Jour. Econ. Biol., Vol. 7, No. 3.) [63.27.]

Live Stock—

Über den Einfluss der Verwandtschaftszucht auf die Fruchtbarkeit beim weissen Edelschwein, *Dr. Frölich.* (Fühling's Landw. Ztg., 15 August, 1912.) [63.64.]

The Meat Industry, *Loudon M. Douglas.* (Jour. Roy. Soc. Arts, July 5, 12 and 19, 1912.) [63.75.]

Der Einfluss der Rasse und des Alters auf die Ausnutzung des Futters beim Rindvieh, *H. P. Armsby* und *J. August Fries.* (Landw. Jahrb., XLIII. Bd., Heft 1, 1912.) [612.394; 63.604.]

Zur Abstammung des schwarzweissen Rindes, *D. L. Bakker* (Mitt. Deut. Landw. Gesell., 28 September, 1912.) [63.62; 63.602.]

Probable Error in Pig-feeding Trials, *G. W. Robinson* and *E. T. Halnan* (Jour. Agr. Sci., October, 1912.) [63.64.]

Concerning the Fat-Tail and the Broad-Tail Sheep, *C. C. Young.* [63.63.] Transmission of Colour and Colour Markings in Hereford-Shorthorn Crosses, *P. E. Fogle.* [575.1; 63.62.] (Amer. Breeders' Mag., Vol. III., No. 3, 1912.)

Dairying and Food, General—

The Illawarra Breed of Dairy Cattle, *F. McCaffrey.* (Amer. Breeders' Mag., Vol. III., No. 3, 1912.) [63.711.]

Forestry—

Beiträge zur forstlichen Samenkunde. IV.—Zur Anatomie und Keimung einiger Koniferensamen, *G. Lakon.* (Naturw. Ztsch. Forst. u. Landw., August, 1912.) [63.492; 63.49–19.]

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Missouri Agricultural Experiment Station.—Research Bull. 1:—An Experimental Study of the Rest Period in Plants: The Winter Rest: First Report. (105 pp.) Columbia, Missouri, 1910. [58.11.]

Alberta Dept. of Agriculture, Seed and Weed Branch.—Bull. 1:—Weeds of Alberta. (87 pp.) Edmonton, 1912. [63.259(04).]

Van Slyke, L. L.—Fertilisers and Crops: or the Science and Practice of Plant-Feeding. (734 pp.) New York: Orange Judd Co., 1912. [63.16(02).]

Troisième Congrès International de Botanique, Brussels, 1910.—Actes du Congrès. Vol. I.—Comptes-Rendus des Séances: Excursions, etc. (385 pp. + 16 plates.) Vol. II.—Conférences et Mémoires. (236 pp. + lvii. plates.) Bruxelles [1911]. [63(063); 58(02).]

Marshall, Charles E. (edit.).—Microbiology for Agricultural and Domestic Science Students. (xxi. + 724 pp.) London: J. & A. Churchill, 1912. 10*s.* 6*d.* net. [576.8.] [The editor is Professor of Bacteriology and Hygiene in the Michigan Agricultural College.]

Memoirs of the Geological Survey, England and Wales.—The Water Supply of Surrey from Underground Sources, with records of Sinkings and Borings. (352 pp. + map.) London: E. Stanford, 1912. 7*s.* [55:912; 628.7.]

Deutsche Landwirtschafts-Gesellschaft.—Arbeiten. Heft 228:—Ergebnisse fünfjähriger Düngungsversuche. (194 pp.) [63.16(02).] Heft 226:—Das Unkraut im Ackerboden: Ergebnisse der Untersuchung von Ackerboden aus verschiedenen Teilen Deutschlands auf Unkrautsamen. (87 pp.) [63.259(04).] Berlin: Paul Parey, 1912.

Balfour, Colonel.—Concise Farmer's Account Book. [11th edition.] (46 pp.) Cupar: J. & G. Innes, "Fife Herald and Journal" Offices. 2*s.* 3*d.* post free. [657.]

Horticulture—

Dean, A.—Root and Stem Vegetables. (114 pp. + 8 plates.) London: T. C. & E. C. Jack [1912]. 1*s.* 6*d.* net. [63.51.]

Tuskegee Normal and Industrial Institute.—The Canning and Preserving of Fruits and Vegetables in the Home. (8 pp.) Tuskegee Institute, Alabama, 1912. [664.84; 664.85.]

Institut Agrícol Català de Sant Isidro.—Concurs d'Embalatges, Juny de 1912. (75 pp.) Barcelona, 1912. [63.41–198.]

Plant Diseases—

Delaware Agricultural Experiment Station.—Bull. 91:—The Relation of Parasitic Fungi to the Contents of the Cells of the Host Plants. (I.—The Toxicity of Tannin.) (77 pp.) [63.24(04).] Bull. 97:—The Relation of Parasitic Fungi to the Contents of the Cells of the Host Plants. (II.—The Toxicity of Vegetable Acids and the Oxidising Enzyme.) (53 pp.) [63.24(04).] Newark, Delaware, 1912.

India, Dept. of Agriculture.—Memoirs, Botanical Series, Vol. IV., No. 6:—The Morphology and Parasitism of Rhizoctonia. (115–153 pp. + xii. plates.) Calcutta, 1912. [63.24.]

Arkansas Agricultural Experiment Station.—Bull. 109:—Diseases of Apple Trees and Fruit caused by Fungi and Insects. (411–446 pp.) Fayetteville, Ark., 1911. [63.24–41; 63.27–41.]

Montana Agricultural Experiment Station.—Circ. 16:—The Pear Leaf Blister-Mite (*Eriphyes pyri* (Pgst.), *Nal.*). (115–118 pp.) [63.27.] Bull. 86:—The Use of Soap to Retard the Settling of Certain Arsenicals. (37–45 pp.) [63.294.] Bozeman, Montana, 1911.

Missouri State Fruit Experiment Station.—Circ. 5:—Spray Calendar. (5 pp.) Mountain Grove, Mo., 1911. [63.294.]

Live Stock—

Société du Herdbook de la Race Bovine Rouge de Flandres.—La Race Bovine Rouge de Flandres. (47 pp.) Roulers, n.d. [63.62 ; 63.602.]

Dairying and Food, General—

Wisconsin Agricultural Experiment Station.—Research Bull. 25 :—Studies in the Factors Concerned in the Ripening of Cheddar Cheese. (54 pp.) Madison, Wis. [63.736.]

Missouri Agricultural Experiment Station.—Research Bull. 2 :—A Study of the Cause of Wide Variation in Milk Production by Dairy Cows. (106–148 pp.) 1910. [63.711(*b*).] Bull. 100 :—Influence of Fatness of Cow at Parturition on Per Cent. of Fat in Milk. (183–202 pp.) [63.711(*a*).] Columbia, Missouri, 1912.

Lancashire County Council.—Farmers' Bull. 23 :—Report on Milk Tests and Records, 1911. (18 pp.) Preston, 1912. [63.711(*b*).]

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Bull. 149 :—The Normal Composition of Dairy Butter. (31 pp.) [63.721.] Bull. 151 :—A Study of the Gases of Emmental Cheese. (32 pp.) [543.2 ; 63.736.] Circ. 204 :—Officials, Organisations and Educational Institutions connected with the Dairy Interests (1912). (26 pp.) [63.7(73).] Washington, 1912

Veterinary Science—

Louisiana Agricultural Experiment Station.—Bull. 132 :—A Simple, Effective and Inexpensive Method of Treating the Arsenical Dipping Solution before Emptying Vat for Cleaning. (8 pp.) Baton Rouge, La., 1911. [619.3(*a*).]

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Bull. 152 :—Studies on the Biology of the Texas-Fever Tick (Supplementary Report). (13 pp.) Washington, 1912. [619.2(*e*).]

Birds, Poultry and Bees—

Iowa Agricultural Experiment Station.—Bull. 125 :—Trussing and Boning Chickens for Fancy Trade. (18 pp.) Ames, Iowa, 1911. [63.751 ; 63.651.]

New South Wales Dept. of Agriculture.—Farmers' Bull. 57 :—Egg-laying Competitions at Hawkesbury Agricultural College and Experiment Farm, Richmond, New South Wales : Ten Years' Work. (14 pp.) Sydney, 1912. [63.65(04).]

Laurie, D. F.—Poultry Foods and Feeding. (188 pp.) London : Cassell & Co., 1912. 2*s.* 6*d.* net. [63.65(02).]

Minchin, E. A.—An Introduction to the Study of the Protozoa, with Special Reference to the Parasitic Forms. (520 pp.) London : Edward Arnold, 1912. 21*s.* net. [59.2.]

Forestry—

Baker, R. T., and *Smith, H. G.**—A Research on the Pines of Australia. (458 pp. + 298 fig. + 3 maps.) Sydney, 1910. [63.49(9) ; 63.492.] [Published by authority of the Government of New South Wales.]

U.S. Dept. of Agriculture, Forest Service.—Bull. 111 :—Lightning in relation to Forest Fires. (40 pp.) Washington, 1912. [63.49–2.]

Eberhard, J.—Tafeln zur Bonitierung und Ertragsbestimmung nach Mittelhöhen [Höhen-Ertragskurven] für Tanne, Fichte, Forche, Buche und Eiche. Langenbrand (Württ.) : Selbstverlag. 1909. [63.49 : 31.]

Hesse-Darmstadt, Abteilung Land- und Forstwirtschaft.—Heft I. :—Die Forst- und Feldstrafgesetzgebung im Grossherzogtum Hessen. (66 pp.) 1904. [63.49(43).] Heft V. :—Die Forstverwaltung im Grossherzogtum Hessen. (74 pp.) 1907. [63.49(43).] Darmstadt.

Hesse-Darmstadt, Zentralstelle für die Landesstatistik.—Mitteilungen aus der Forst- und Kameralverwaltung für das Jahr 1910. (43 pp.) [Beiträge zur Statistik des Grossherzogtums Hessen. Band 62, Heft 2, 1912.] [63.49(43).]

Wurtemberg, K. Forstdirektion.—Forststatistische Mitteilungen aus Württemberg für das Jahr 1910. (107 pp.) Stuttgart, 1912. [63.49(43).]

Hagen, Otto von.—Die forstlichen Verhältnisse Preussens. [Dritte Auflage.] (Zwei Bände.) (310 + 419 pp.) Berlin: Julius Springer, 1894. [63.49(43).]

Saxony.—Geschäftsordnung fur die Königlich Sächsische Staatsforstverwaltung einschl. der Forsteinrichtungsanstalt und der Forstakademie. I. Band. Verwaltung und Diensteinrichtung. (270 pp.) 1910. II. Band. Forsteinrichtung und -betrieb. (165 pp.) 1911. Dresden: C. Heinrich. [63.49(43).]

Grundner und *Schwappach.*—Massentafeln zur Bestimmung des Holzgehaltes stehender Waldbäume und Waldbestände. [Dritte, erweiterte Auflage.] Berlin: Paul Parey, 1907. [63.49 : 31.]

Engineering—

Deutsche Landwirtschafts-Gesellschaft.—Arbeiten. Heft 222:—Hauptprüfung der Drillmaschinen. Vorprüfung neuer Geräte Cassel 1911. (77 pp.) Berlin: Paul Parey, 1912. [63.17.]

Economics—

International Institute of Agriculture.—L'Activité de l'Institut International d'Agriculture en Matières de Coopération, d'Assurance et de Crédit Agricoles. (35 pp.) Rome, 1912. [334(04); 332.71(04); 368.]

International Institute of Agriculture.—Étude métodologique et statistique sur les recensements de la population agricole, les salaires de la main-d'œuvre rurale et les courants d'émigration dans les différents États. (150 pp.) Rome, 1912. [312; 325.2; 331.]

Institut International d'Agriculture.—Recueil des Coefficients pour la Conversion des Poids, Mesures et Monnaies au Système Métrique décimal. (63 pp.) Rome, 1912. [389.]

Institut International de Statistique.—Statistique Internationale des États. des Cultures. (106 pp.) Rome, 1911. [311.]

International Institute of Agriculture.—"The Way out of the Rut." Correspordence and Comments on the European Co-operative Rural Credit Systems. Their Adaptation to the need of the American Farmer. (24 pp.) Rome, 1912. [332.71(04).]

Wolff, H. W.—Co-operation in Agriculture. (378 pp.) London: P. S. King and Son, 1912. 6*s.* net. [334(02).]

France, Ministère de l'Agriculture, Office de Renseignements Agricoles.—Enquête sur les Salaires Agricoles [Extrait du Bulletin mensuel de l'Office des Renseignements Agricoles]. (495 pp.) Paris, 1912. [331.]

Millard, P. W.—The Law relating to Tithe Rentcharge and other Payments in lieu of Tithe. (xxiii. + 202 pp. + index of 34 pp.) London: Shaw and Sons, 1912. 4*s.* 6*d.* net. [348.]

Ohio Agricultural Experiment Station.—Circ. 116:—The Rural Population of Ohio. Where is it increasing or decreasing? Why? (15–22 pp.) Wooster, Ohio, 1911. [325.3.]

Pellervo Gesellschaft.—Betriebsstatistische Untersuchungen über die Molkerei-, Kredit-, und Konsum-Genossenschaften in Finland, 1903–1910. (xxiii. + 248 pp. + map.) Helsingfors, 1912. [334(47); 63.7(47).]

Prothero, R. E.—English Farming Past and Present. (504 pp.) London: Longmans Green & Co., 1912. 12*s.* 6*d.* net. [63(09).]

*Ireland, Dept. of Agriculture and Technical Instruction.**—The Agricultural Output of Ireland, 1908. Report and Tables prepared in connection with the Census of Production Act, 1906. (27 pp.) London: Wyman & Sons, 1912. 2*d* [31(415).]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P. 10–9. 6,000. 12/12. R. C. & S., Ltd.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE

Vol. XIX. No. 10.

JANUARY, 1913.

PARTIAL STERILISATION OF SOIL FOR GLASS-HOUSE WORK.

E. J. RUSSELL, D.Sc., and F. R. PETHERBRIDGE, B.A.,
Rothamsted Experimental Station.

IN an earlier Report, published in the issue of this *Journal* for January last (Vol. XVIII., No. 10, 1912), we described the effects produced by the partial sterilisation of soil, and showed that they are of three kinds: (1) the bacterial activity of the soil is increased, and plant food is made more rapidly *; (2) disease organisms and pests are killed or greatly reduced in numbers; and (3) the changes going on in the soil are somewhat modified, so that certain unusual substances are present which produce special effects on the plant. Partial sterilisation is therefore useful to growers who are troubled with soil "sickness" and insect or fungoid pests in the soil, and to those who wish to obtain the special effects which are not so readily produced on untreated soil.

There are two general methods of partial sterilisation. The soil may be heated to about 200° F. by steam or dry heat, or it may be treated with chemical antiseptics. Up to the present time heat has been found to give the better results, because it not only kills the various detrimental and disease organisms, but it also brings about a certain amount of decomposition, thus lightening the subsequent work of the food-making bacteria, while in some instances it improves the physical condition of the soil. Chemical treatment is cheaper and more convenient in practice, but, on the other hand, is less effective, even when thoroughly done; it is also difficult to effect thoroughly, since some of the antiseptics cannot readily be distributed uniformly in the soil, even by watering, because they are absorbed by the top layer of soil from their solutions or emulsions.

---

* A little confusion has arisen on this point. It is sometimes said that partially sterilised soils contain more nitrogen than unsterilised soil. This is an error, as they actually contain a trifle less *nitrogen*, but they contain more *available nitrogenous food.*

None of these difficulties are insuperable, and it would be premature to offer any opinion as to which method will finally prove better for the grower. The more effective must in the end be the more profitable, but there is nothing to show that chemical treatment will always be less effective than heat, and, in fact, the difference between them has been distinctly reduced by the use of new antiseptics.

Partial Sterilisation by Heat.

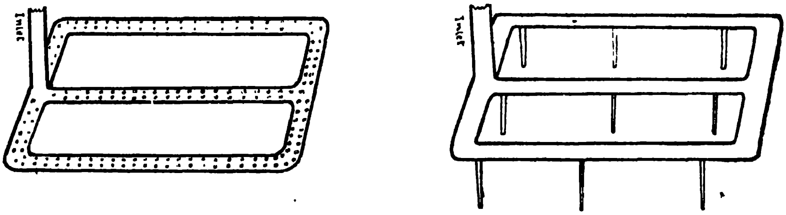
Two methods of partial sterilisation by heat are in use. In one the soil is heated directly by means of a coke fire; in the other it is subjected to the action of steam. The choice is largely dictated by convenience and engineering detail, there being no sufficient evidence of any difference in effectiveness when the soil is equally heated in both cases.

In the direct heat sterilisers the soil is heated for a number of hours, and is then removed to make way for another charge; the process is practically continuous, and can be worked with but little labour. There are several advantages in working with moist rather than dry soil; the danger of overheating is minimised, and the heat travels more rapidly and uniformly throughout the mass, since moist soil is a better conductor than dry soil.

Several methods have been adopted for heating by steam. Perhaps the best known consists in blowing steam into the soil through a gridiron-shaped instrument 4 or 5 ft. by 3 or 4 ft. (Fig. 1*a*), made of 1 in. piping perforated with holes one-eighth of an inch in diameter. This instrument is placed in a wooden frame without top or bottom, and capable of holding a load or more of soil. Soil is then filled in, and the whole is covered with sacks. Connection with the boiler is made by a 2 in. hose pipe, and steam is blown in for about 20 to 30 minutes.* When high pressure (80 lb.) is available a larger amount of soil can be treated at once; when only low pressure can be used, the soil should not be too wet to begin with, or much condensation may occur. Considerable economy can be effected by performing the operation in the house itself, and moving the tackle along the borders as each piece is treated.*

---

* It is not certain whether the armoured hose pipe will prove sufficiently durable or whether the more costly flexible metal hose is necessary. The most economical pressure is not yet ascertained, good results having been obtained both at low and at high pressures.



a. *b.*

FIG. 1.

Another implement used in precisely the same manner is shaped like a harrow; this is also made of gas piping, but is fitted with nine or more tines of smaller piping, perforated with holes, out of which the steam issues. (*Fig.* 1*b*.)

An appliance adopted in America is on the principle of a warming-pan. A galvanised iron vessel, 10 ft. × 6 ft. × 6 in. is connected with the boiler, and then pressed down an inch or two into the soil which has already been prepared for the plants. Steam is now blown into the vessel for 40 minutes at a pressure of 100 lb.; none escapes into the soil, but there is considerable passage of heat. The process is sometimes done by contract, and is estimated to cost about a shilling for 33 sq. ft. We have not seen the process at work, and do not know that it is in use in this country.

In the gridiron or harrow method it is hardly necessary to use a thermometer; the temperature cannot rise above 212° F., and will not usually be much below if the steam is at the pressures already mentioned. The soil, after removal from the sterilising frame, may be thrown into a heap, and cools so slowly that the sterilising process still continues. The heap, however, should not remain out of doors for long without protection; every shower of rain washes away valuable plant food, and every wind may bring plant disease germs and other undesirable organisms to repopulate the soil. Among the advantages of sterilising inside the house is the avoidance of these sources of injury. We have not yet sufficient data to determine the cost, but we have seen houses done at a cost of 4*d.* to 6*d.* per sq. yard.

---

* An ingenious modification consists in making the implement like a comb with three prongs, the ends being blocked up and the piping perforated as before. This can be hauled out of the borders more readily than the gridiron.

It is not yet possible to say whether soils may profitably be sterilised very long before they are wanted. In commercial cucumber houses, for example, there would be obvious advantages in carrying out the sterilisation during the slack months from October onwards; but as the borders are not made up till February, the risk of infection is increased if the treatment is carried out too early. In course of time a copious development of mould often takes place in heated soils carrying no crops, but we have no evidence that it is detrimental to plant growth. This, however, is essentially a matter where convenience counts; even if a loss does go on in the stored soil, it may still be advantageous to sterilise early when other work is slack.

Seeds sown during winter and early spring in this heated soil do not germinate as quickly as in untreated soil, and the seedlings are apt to be rather stunted and dark green in colour. Tomatoes also show a purple coloration in the stems and the backs of the leaves. Fig. 2 shows a box of cucumber seedlings in heated soil side by side with another lot sown the same day in the same soil, which, however, had not been heated. Bad seed is more affected than good seed. Young plants raised in heated soil also suffer a longer check after pricking out. The roots, however, grow more quickly than the tops; stunted plants in heated soil which, in the "sixties" pots, appeared to be distinctly poorer than those in untreated soil, have not infrequently been found to possess much better roots when knocked out. The extent to which these effects show depends on the season, the light, the soil, &c., and we have not yet learnt how to control them; sometimes they pass so quickly that they are hardly observable. In any case they need not cause anxiety, for the retardation ceases soon after the second leaves are out, and a great increase in growth sets in, soon carrying the plants well ahead of those on untreated soils.

Partial Sterilisation by Chemical Methods.—The Use of Antiseptics.

In our earlier experiments we confined ourselves to two antiseptics that happened to be very convenient for our own purpose. The experiments have since been extended to include a number of other antiseptics belonging to six different classes, so as to ascertain how wide a choice would be open to the horticulturist. The groups tested were:—1. Volatile hydrocarbons: toluol, light solvent naphtha, benzene, petrol, &c.; 2. Heavy hydrocarbons and their derivatives: naphthalene, &c.; 3. Tar acids: carbolic acid, cresylic acid or cresol, &c.; 4. Tar bases: pyridene and the higher bases, lutidene, collidene; 5. Formaldehyde; 6. Inorganic antiseptics: calcium sulphide.

The substances in the first group, the volatile hydrocarbons, gave good results in our glasshouse, but proved very troublesome when we came to use them in commercial nurseries. There was great difficulty in applying them to the soil: a hand injector proved too laborious, and spraying too wasteful; further, they had little action in wet soil by reason of their insoluble nature. Another objection of a wholly different kind, but no less serious, was the trouble about carriage, railway companies declining to carry them except in special packages conforming to the Railway Clearing House specification and at a minimum charge of 5*s*. Where road or water transport was available the charges were less, but the material was a long time in reaching its destination. These difficulties may be overcome in time, but for the present they put out of the range of practice all the volatile hydrocarbons, and the other volatile substances, such as carbon disulphide and ether.

The second group, the heavy hydrocarbons, is very large, and includes heavy solvent naphtha, naphthalene and its reduction products, with other of the waste products obtained in the isolation and refining of naphthalene, besides certain other substances obtained when some of these waste products have been subjected to special treatment whereby their purely hydrocarbon character is lost (we do not set up a rigid chemical definition of this group). Of these products, naphthalene is a solid, and is therefore easily transported and applied; on the other hand, it does not dissolve in water, and hence does not readily spread about in a cold soil. It is, however, fairly volatile, and will quickly change into vapour and do its work at the higher temperature of a cucumber house. The other products are liquids, but, being non-inflammable, require only ordinary drums for transport, and are carried at ordinary rates; some mix or emulsify so readily with water that they can be watered into the soil with the greatest ease, but others will not emulsify until they have been mixed with some other substance. The advantage of being able to water in the disinfectant is so great that only the soluble or easily emulsifiable substances are likely to prove of practical value. Even these, however, are not as easily distributed in the soil as might be supposed; many of them are abstracted by the soil from their solutions or emulsions, so that they fail to travel into it to any great distance. Thus, when they are watered in, only the top two or three inches of the soil actually get much antiseptic, and the water that penetrates to greater depths may contain an insufficient amount of the antiseptic to serve any useful purpose. This effect is most marked in heavy soils and in those containing much organic matter derived from turf or stable manure.

The tar acids, which form our third group, are already used in glasshouses as disinfectants. At least four occur in the well-known "straw-coloured carbolic"—phenol and the three cresols—but we have no information as to whether any one of the four is more useful than the rest. The acids are effective, but they do not dissolve or emulsify to a sufficient extent in cold water, although they dissolve more easily if soft soap is added, and are completely soluble in warm water. They also are abstracted from their emulsions by soil, so that they do not readily penetrate to a great depth.

The tar bases have the advantage of supplying some plant food as well as partially sterilising the soil, and their nitrogen rapidly becomes available for the plant. They have a very powerful odour, which may, indeed, prove too much for the horticulturist, but they can be converted into less odorous solid salts, with which, however, we have not experimented.

Formaldehyde has the advantage of being volatile, so that it spreads readily in the soil without being absorbed locally like some of the substances mentioned above. It has proved the most effective antiseptic we have tried. In the pure state it is a gas at ordinary temperatures, but it readily condenses, and is sold as a 40 per cent. solution in water. Sometimes the solution is called *Formalin*, but this name is the property of a particular German firm, and their brand has to be supplied

FIG. 2.—Cucumber seedlings grown in (*a*) untreated soil, (*b*) the same soil steamed.

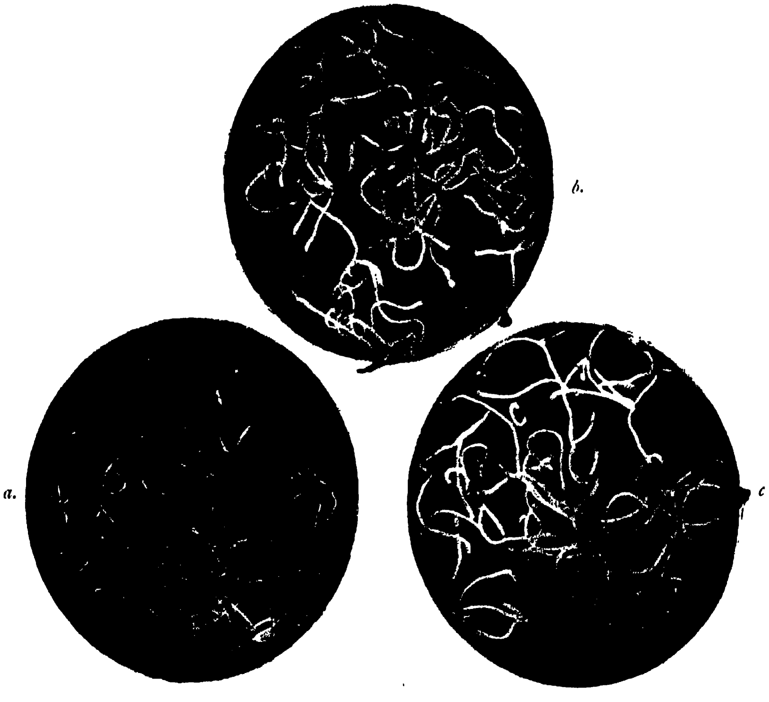


FIG. 3.—Tomato seedlings raised in sick soil: (*a*) untreated; (*b*) heated to 130° F.; (*c*) steamed. Note the healthy appearance of seedlings on the heated soils as compared with those on the untreated soil.

whenever formalin is asked for; "40 per cent. Formaldehyde," however, is not a proprietary article, and can be manufactured and sold by anyone. It has an irritating smell, but does no injury to the men if properly used.

Of the inorganic antiseptics we have as yet only used calcium sulphide. This proved very effective, and, moreover, it changes after its work is done into useful calcium carbonate. It is not at present obtainable on a large scale. It used to constitute the old-fashioned gas lime, the so-called "Blue Billy," but only small amounts are found in the gas lime commonly sold at the present day, owing to recent changes in the method of gas purification.*

The group is, however, very large, and contains many other substances, some of which, such as sulphur and boracic acid, have been recently tried by other investigators with results said to be satisfactory. Lime in sufficient doses has been found very good. Bleaching powder also appears to be promising.

Some objections may be found to all the substances in these groups. The first group is readily distributed in the soil, but is highly inconvenient in practice with our present methods; the second and third groups are very convenient to handle, but are apt to distribute badly in the soil owing to local absorption; the fourth group has a bad odour, but otherwise answers well; formaldehyde at the present moment is expensive (7*d.* per lb.), although there seems no reason why its price should remain high if it were made on a larger scale. We have not yet met with the ideal combination of qualities in any one substance, and the grower's choice must be determined by three considerations—effectiveness, convenience, and price.

The effectiveness of an antiseptic varies with the conditions under which it is used, so that it is impossible to set out a number of substances in any rigid order of merit. Only a rough grouping into classes can be attempted, and it must be realised that a different method of application would cause a certain amount of readjustment in the classification. During the present season's work the antiseptics have come out in the following groups:—

---

* Horticulturists should remember that two very different substances pass under the name of gas lime: the old "Blue Billy," still obtainable in places if specially asked for, and the highly carbonated substance commonly sold now. The old gas lime had a great reputation as an insecticide and fungicide, but there is nothing to show that the modern carbonated substance is anything like so effective. Many of the statements still made on the subject in print and elsewhere have been handed down from old text-books; they may have been true of the old gas lime but do not necessarily hold good now. Before an expert advises gas lime or a horticulturist uses it as a disinfectant for glasshouses, he should satisfy himself that the material actually obtainable will have the desired effect.

1st Group, most effective.—Formaldehyde, pyridene, the higher bases, collidene, lutidene, &c.

2nd Group, less effective.—Benzene, calcium sulphide, carbolic acid, cresylic acids (*i.e.*, cresols), light solvent naphtha, heavy solvent naphtha, petrol, toluol.

3rd Group, still less effective.—Naphthalene and certain derivatives obtained during its preparation,* nitrobenzene.

The order within the groups is alphabetical only. These groups are based on the effects observed on our tomato plants and the fruit picked up to the middle of July, but later on certain other effects appeared which would cause some of the third group to be moved up into the second, and *vice versa.* On the whole, however, the early effects and the early fruit are the more important, and we therefore prefer to leave the list as it stands.

Reference to the Tables (pp. 819 and 821) shows that none of these substances are as effective as heat, but several are much superior to toluol, the best agent we knew last year. This fact encourages the hope that we may yet find even more useful substances than those in our present 1st group.

The relative convenience of working with these various substances can only be ascertained by large-scale experiments in commercial glasshouses. Three kinds of application are involved: applications of volatile substances, of solutions or emulsions, and of solids, but there seems no reason why any of these should prove beyond the power of the horticulturist.

The question of price is naturally one about which no general statement can be made. Some of the above substances are by-products and not much in demand; at the moment their price may be low, but it is liable to increase once the demand increases. Others are definitely manufactured and put on the market, but usually for some special purpose requiring more or less costly treatment unnecessary for horticultural use. How little the current price of a substance likely to be used in agriculture or horticulture is an index of its future price is shown by the history of superphosphate; prior to the time of the first artificial manure factory superphosphate was simply a chemical curiosity unobtainable on the market in any quantity. For this reason we have taken no account of current prices in making our choice of antiseptics for trial, but have included any substance that seemed likely to be producible cheaply. Many waste products are cheap, but they are very variable in composition and no uniformity is guaranteed; our experience is that for the present purpose they cannot be recommended until they have been examined carefully and the behaviour of their separate constituents is known. In practice this necessitates a certain amount of manufacturing and standardisation, which becomes a factor in determining the final price. Only actual trial avails to determine what is and what is not a useful antiseptic; remarkable actions go on in the soil, rendering innocuous substances which *à priori* might be supposed to be very injurious.*

---

* We have only examined a few of the very numerous naphthalene derivatives, and it must be distinctly understood that the above grouping has reference only to the substances we have used, and does not imply that all naphthalene derivatives fall into the third group.

The Treatment of "Sick" Soils.

Tomatoes.—Partial sterilisation of sick soils has four beneficial effects: (1) it cures the sickness; (2) it kills the disease organisms in the soil; (3) it increases the supply of plant food; and (4) it leads to some changes in the habit of the plant, which, however, may be of very little value to the commercial grower.

A thoroughly bad tomato-sick soil obtained from a grower in the Lea valley was used in these experiments; some was partially sterilised in various ways, while the rest was left untreated. The heating was done by means of steam in substantially the manner already described. The chemicals were applied in the manner described below. The soil was spread out, watered with a solution of the antiseptic, and mixed up with a shovel. It was then allowed to stand in the pots for two or three days, and afterwards turned out to allow the worst of the smell to pass away. One part by weight of commercial formaldehyde (=40 per cent. pure formaldehyde) was used to one thousand parts by weight of soil, or, in other words, 1½ pints mixed with water was added to one ton of soil; 2½ times this quantity of other antiseptics was used. We obtained evidence, however, that these dressings were too large and could advantageously be reduced, especially if some means were devised for effecting as complete a mixture as was made in our pots. On March 1st, seeds of Sutton's Satisfaction were sown; seven days later many plants were up, but those on the untreated soil were behind the rest. By the 12th the young plants already began to show some differences, and the various modes of treatment could be arranged in an order of merit, which was maintained throughout the experiment. Trouble soon began to set in through the attacks of eelworm (*Heterodera*) and the "damping off" fungus (*Pythium*), causing the loss of many plants on the untreated soil, so that we constantly had to bring in new ones from the reserve stock, and, after this was exhausted, from spare plants growing in heated soil. Fig. 3 shows tomato seedlings grown on sick soil and on the same soil after heating. Eelworm did practically no damage in any of the partially sterilised soils, and no knots could be seen on the roots when the plants were repotted. Later on numerous knots appeared where the soils had been treated with toluol, benzene, and petrol. The other antiseptics were more effective in killing eelworm, and very few knots developed; there were none at all in soils treated with formaldehyde, carbolic acid, or steam heat. Damping-off did not appear in soils heated to 200° F., or treated with formaldehyde, carbolic acid, or cresylic acid, although it set in to some extent on the other soils, but never as badly as on the untreated soil. On the 18th April, when the plants were potted into "thirty-twos," those growing in the soils heated to 200° F. and treated with formaldehyde and carbolic acid had excellent roots; the two former lots also were short jointed and compact, whilst those on the pyridene-treated soil were already marked out by their large leaves. Flowering

---

* For example, Fowler, Ardern and Lockett have discovered (*Proc. Roy. Soc.*, 1910, 83 B, 149) that certain bacteria can destroy carbolic acid by oxidation, and Mooser has studied the rate at which carbolic acid and cresol disappear from the soil (*Landw. Versuchs-Stat.*, 1911, **75**, 57).

was now beginning; first on the plants in the steamed and formaldehyde-treated soils, next on those in the soils treated with carbolic acid and toluol, later on plants in the other treated soils, and last of all on the plants in the untreated

TABLE I.—Weight of fruit picked per surviving plant from Tomatoes grown on a bad "tomato sick" soil.

Soil Treatment.	Mortality, *i.e.* percentage of Plants that Died after being Potted up.	Fruit Picked per surviving Plant up to				
		July 17.	Aug. 9.	Sept. 16.	End of Season.	
		Grams.	Grams.	Grams.	Grams.	Lb.
Untreated	66	121	514	1,011	1,113*	2·5
Heated	None	521	1,119	1,335	1,488	3·3
1st Class:—						
Formaldehyde †	None	376	804	1,123	1,339	3·0
Pyridene †	16	288	751	1,194	1,352	3·0
Higher bases, Collidene, &c.	33	267	917	1,296	1,445	3·2
2nd Class:—						
Benzene	33	120	526	1,131	1,354	3·0
Calcium sulphide...	33	147	486	1,036	1,338	3·0
Carbolic acid...	None	158	499	975	1,096	2·4
Cresylic acid	None	152	426	1,078	1,181	2·6
Heavy solvent naphtha ..	33	137	594	1,131	1,318	2·9
Light solvent naphtha... ...	50	146	515	1,118	1,411	3·1
Petrol	None	159	604	1,114	1,320	2·9
Toluol (crude)	16	150	631	978	1,090	2·4
Toluol (refined)	16	198	568	1,018	1,299	2·9
3rd Class:—						
Naphthalene...	16	104	513	1,201	1,343	3·0
Naphthalene residue "C"...	16	87	417	1,025	1,255	2·8
Nitrobenzene	16	83	418	1,102	1,208	2·6

* There were very considerable losses of plants on the untreated soil of which no account is taken in this column, which deals only with the surviving plants. The losses on the partially sterilised soils were much smaller. If instead of giving the yield per surviving plant we set out the yield per 100 plants potted up, the untreated soil comes out very badly indeed.

† One part per thousand of soil, *i.e.*, 2 lb. of antiseptic watered on to a ton of soil; 2½ times this quantity was used for all the other antiseptics. We had reason to suppose, however, that these amounts were too large.

The yields are stated in grams per plant, this being our most convenient mode of measurement. There are 458 grams in 1 lb.

soil. By May 9th the fruit had set on the plants in several of the treated soils, and it had become necessary to start feeding, while on the untreated soil flowering had not even begun, and the plants were still dying from various causes. Fig. 4 shows some of the plants at this stage. Only four trusses were allowed to develop, and the plants were then

stopped. Table I. shows the amounts of fruit picked per plant at various dates; the earliest and largest quantity came from the steamed soil, the next from soils treated with formaldehyde, pyridene, and the higher bases. The other antiseptics fall into the groups already mentioned; we do not further classify them because we cannot attach much importance to some of the small differences in the amount of fruit.

All the plants were equally fed with a mixture containing 3 parts of sulphate of potash, 2 parts of superphosphate, and 2 parts of sulphate of ammonia, supplied at the rate of ½ oz. per plant per week. With this feeding the plants on the untreated soil gave a crop which in the end was not much inferior to that on some of the treated soils. But against this it must be remembered that on the untreated soil the fruit came later, and the mortality among the plants was very high, only a small number of our original stock surviving to the end. On the treated soils, especially the steamed soils and those treated by the more effective antiseptics, the mortality was low, and practically all the plants survived and fruited. The untreated soil comes out very badly in a table showing the yield of fruit per 100 plants potted up.

A similar experiment was carried out on another bad tomato-sick soil from another part of the Lea Valley district. Seeds of "Sutton's Early Market" were sown on April 3rd, and came up most quickly on the heated soils, next on the untreated soil, and slowest on the soil treated with various antiseptics. By the 17th of the month damping-off began, and continued steadily on the untreated soil, to a less extent on the toluol-treated soils, still less on the soils treated with other antiseptics and heated to 130° F., but it did not appear at all on the soils heated to 200° F. By May 29th the plants on the untreated soil were the poorest of the whole lot, and, as in the previous experiment, their mortality was very considerably higher, great losses of young plants taking place. The plants were "stopped" at four trusses, as before. The fruit results are given in Table II., and show that the treated soils gave earlier and larger crops than the untreated, though all were equally fed with the mixture mentioned above.

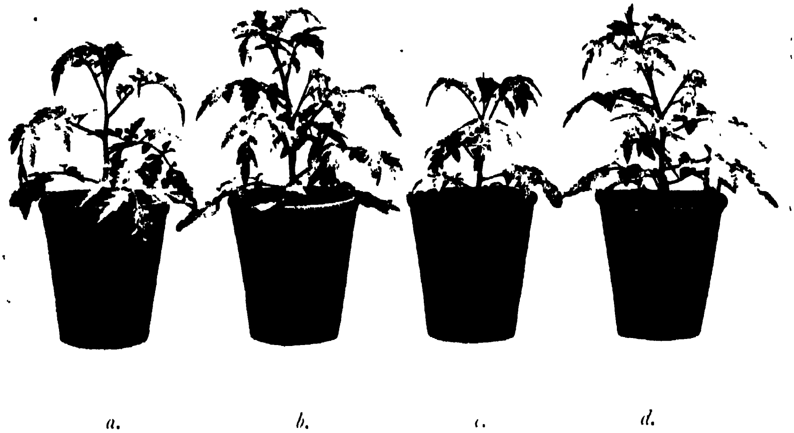


FIG. 4.—Tomato plants in sick soil: (*a*) treated with toluol; (*b*) with formaldehyde; (*c*) untreated; (*d*) steamed.

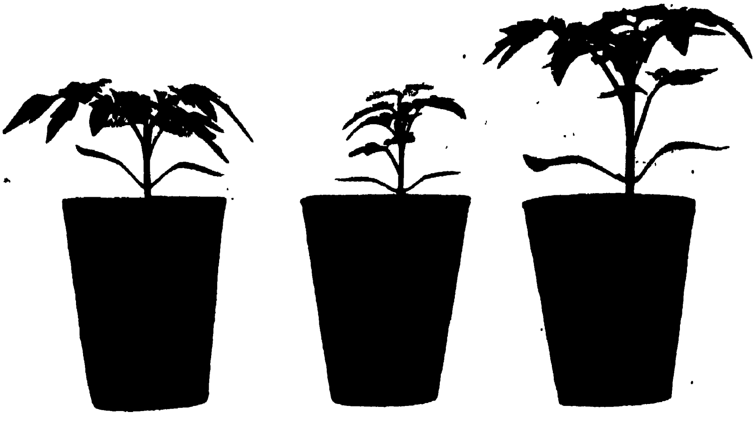


FIG. 5.—Tomato plants growing in tomato-sick soil: (*a*) untreated sick soil; (*b*) soil heated to 330° F.; (*c*) soil heated to 210° F. by steam. Note the bad effect of overheating at this stage of growth.

TABLE II.—Weight of fruit picked from Tomatoes grown on a bad "tomato sick" soil.

Soil Treatment.	Aug. 12. Grams.	Aug. 23. Grams.	Sept. 16. Grams.	End of season. Grams.	Soil Treatment.	Aug. 12. Grams.	Aug. 23. Grams.	Sept. 16. Grams.	End of season. Grams.
Untreated (surviving plants)	0	16	167	845	Untreated (surviving plants)	0	16	167	845
Baked . . .	114	299	607	970	Formaldehyde	52	177	584	884
Steamed . .	114	264	689	1051	Toluol, soil being moist .	17	63	250	819
Overheated. .	73	161	666	1103	Toluol, soil being dry .	25	34	408	962
Plants raised in soil heated to 130° F., then potted into steamed soil .	51	161	670	1048	Thiophen* .	0	44	401	930
					Naphthalene residue "C"	0	8	305	944
					Naphthalene residue "I"	27	88	396	838

* An impurity in commercial toluol.

The general results are, as before, that heating gives the best results, formaldehyde comes next, followed by toluol and certain naphthalene residues obtained from a tar distillery, the early crop being taken as the most important criterion. Various methods of heating were adopted; baking gave rather better results at the beginning, but rather poorer later on, whilst overheating had a bad effect in the early stages (Fig. 5). Other experiments were designed to discover whether we could overcome the effect of the retarded germination and seedling growth often observed in steamed soils. Among them a set was put up to see if anything would be gained by raising plants in soil heated to 130° F. (on which retardation of early growth does not set in), and then potting into steamed soil. All these experiments broke down because, on this particular lot of steamed soil, no retardation appeared, but on the contrary an acceleration of seedling growth.

A further interesting point brought out in this series of experiments is the comparative failure of toluol to act in a moist soil. This is one of the serious disadvantages of volatile insoluble antiseptics for practical purposes.

Simultaneously a number of these experiments were repeated in a commercial glasshouse by a competent grower in order to ascertain whether our results would hold good in practice, or whether any new factor comes into play to upset them. No substantial difference was obtained; retardation of the seedlings on steamed soil was more common than in our house, but it soon ceased and gave place to the usual acceleration. By the time the plants were ready to set out in the house, those raised in steamed soil were usually larger, more compact, with larger, darker leaves, and finer, cleaner roots than those from untreated soil.

It was found, however, that the steamed soils were apt to dry out suddenly and required more frequent but smaller watering than the untreated soil. It is a curious fact that steamed soils require less water than untreated soils to make them look equally wet, and consequently in ordinary practice they never receive quite as much as the untreated soils, and, as they have less reserve supply, they dry up more quickly.

Formaldehyde also gave good results, but toluol was unsuccessful in the one house in which we used it.

All our experiments were made on plants grown in pots. We have no evidence to show what would happen in borders, and whether rankness of growth would set in to any marked extent. Where there is reason to anticipate rank growth on heated soils in borders, precautions should be taken at the outset to guard against it.

Cucumbers.—As we had neither the space nor the labour available for experimental cucumber borders, we carried out experiments in a commercial house to which we were kindly allowed access by the grower. Our object was to compare the old rejected "sick" soil, both sterilised and unsterilised, with virgin soil as material for making up the borders. In the steamed soil there was retarded germination of the seeds sown in December and January, but not of those sown at the end of February or early in March; better root growth was usually obtained in the thirty-twos, and distinct increases over the untreated soil later on. By the time 10 leaves had appeared on the plants in untreated soil there were usually 11 larger ones on the plants in steamed soil. The four soils (two untreated and two heated) were made up into borders in the usual manner, and the plants, after being set out, received the customary manuring and treatment. Fig. 6 shows how much those on the steamed soil grew ahead of those on the untreated soil. Several of the plants on the old

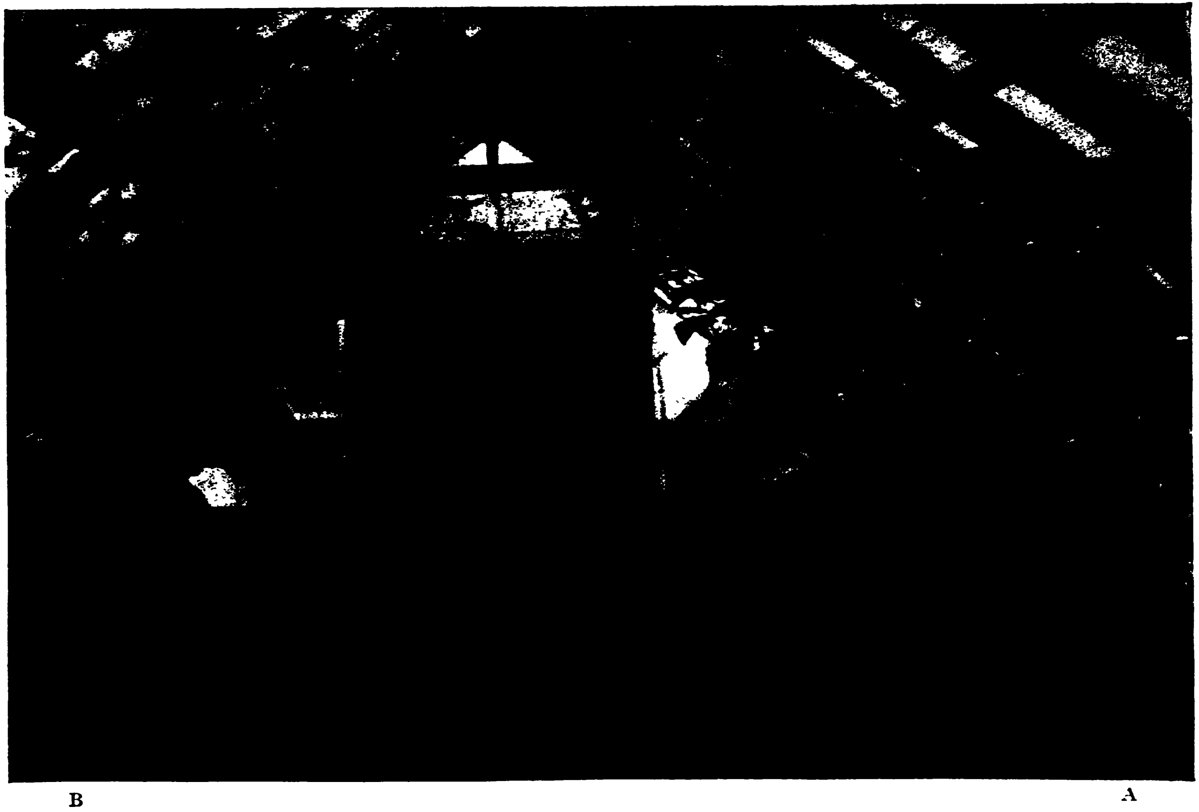


FIG. 6.—Cucumber border made up with : (A) untreated sick soil, (B) the same soil steamed.

untreated soil died of stem rot, but none on the steamed soil. The dates of the first pickings of fruit were:—

Steamed virgin soil	April 29th
Untreated virgin soil	May 6th
Steamed old sick soil	May 6th
Untreated old sick soil	May 12th

The plants on the untreated sick soil gave much less fruit than the others although they received the same manurial treatment. It is important to notice that partial sterilisation of the virgin soil was advantageous, and led to earlier fruiting and an obviously better growth.

No strict comparison can be instituted between the virgin soil and the old soil; in the present experiment, however, the old sick soil sterilised behaved very much like the virgin soil unsterilised.

Vines.—A quantity of vine-sick soil that would no longer grow grapes profitably was sent to us from a Hampshire nursery. The vines made only small growth of wood, and had little surface root, while the leaves fell off early from the lower part of the stem, and those remaining began to turn red in spring instead of in autumn. The grapes "shanked" badly, *i.e.*, they did not finish well, neither sweetening nor colouring properly, and many were shrivelled. Those on the outside border were rather better than those on the inside. In no case was there any obvious disease, nor, on the other hand, was the trouble simply due to soil poverty, for all the usual vine manures had been tried without success. Some of the houses, although not new, had not previously contained vines, and the grower was astonished that the soil should already be vine-sick. This, however, need cause no surprise. It is not the crop that causes sickness of the soil, but the soil that causes sickness of the crop.

In our glasshouse the young vines on the untreated soil behaved just as the grower had stated, making little wood or root, early losing the leaves from the lower part of the stem, while the remaining leaves soon turned red; these appearances, therefore, had not been due to some accidental feature in the grower's house, but were really caused by the soil. By September these plants looked very poor. But the plants in the same soil steamed or treated with formaldehyde made splendid growth even without manure; they produced large leaves, which remained green and attached to the stem till late autumn. (Fig. 7.)

Partial sterilisation therefore appears to be the proper method of dealing with vine-sick soils.

Partial Sterilisation of Virgin Loams and Composts.

On virgin loams and composts partial sterilisation has three beneficial effects:—1. It kills any disease organisms or competing forms in the soil; 2. It increases the supply of plant food; 3. It leads to changes in the habits of the plant.

The presence of disease organisms in the virgin loam or turf in districts where there is much glass is well known to tomato and cucumber growers, but in certain other classes of work it is not a serious factor. Generally speaking, the question of food supply in the soil is not regarded as important, although it must obviously become so as manures rise in price and profits fall. The advantage of partial sterilisation of virgin loams may lie solely in the changes in habit of the plant, and these may not be worth paying for.

As a rule, the plants on the partially sterilised soils are darker green, have larger foliage, stouter stems, earlier and larger flowers, more fruit, and retain their lower leaves longer than plants receiving equal treatment on untreated soils. The larger growth is due to the additional food supply; the difference in this direction between the untreated and the partially sterilised soils can be reduced almost to nothing by giving sufficient suitable manure. There are limits to the growth of every plant, beyond which no amount of food will carry it. In well managed private houses where plants receive great individual attention they may already be making on the untreated soil as full growth as is possible; here partial sterilisation leads to no further increases. But where less attention and manuring can be given it is found that better results are obtained on partially sterilised than on untreated soils. Our experiments in this direction during the present season have been chiefly confined to chrysanthemums.

Chrysanthemums.—In our earlier paper * we showed that the varieties "Reginald Vallis" and "Stansted White" made better growth in partially sterilised than in untreated soil. A similar experience is recorded in the *Gardener's Chronicle* (December 16th, 1911) by Mr. Jas. Atkinson, of Torkington Lodge Gardens, Hazel Grove, Stockport, who

---

* *Journal*, January, 1912.

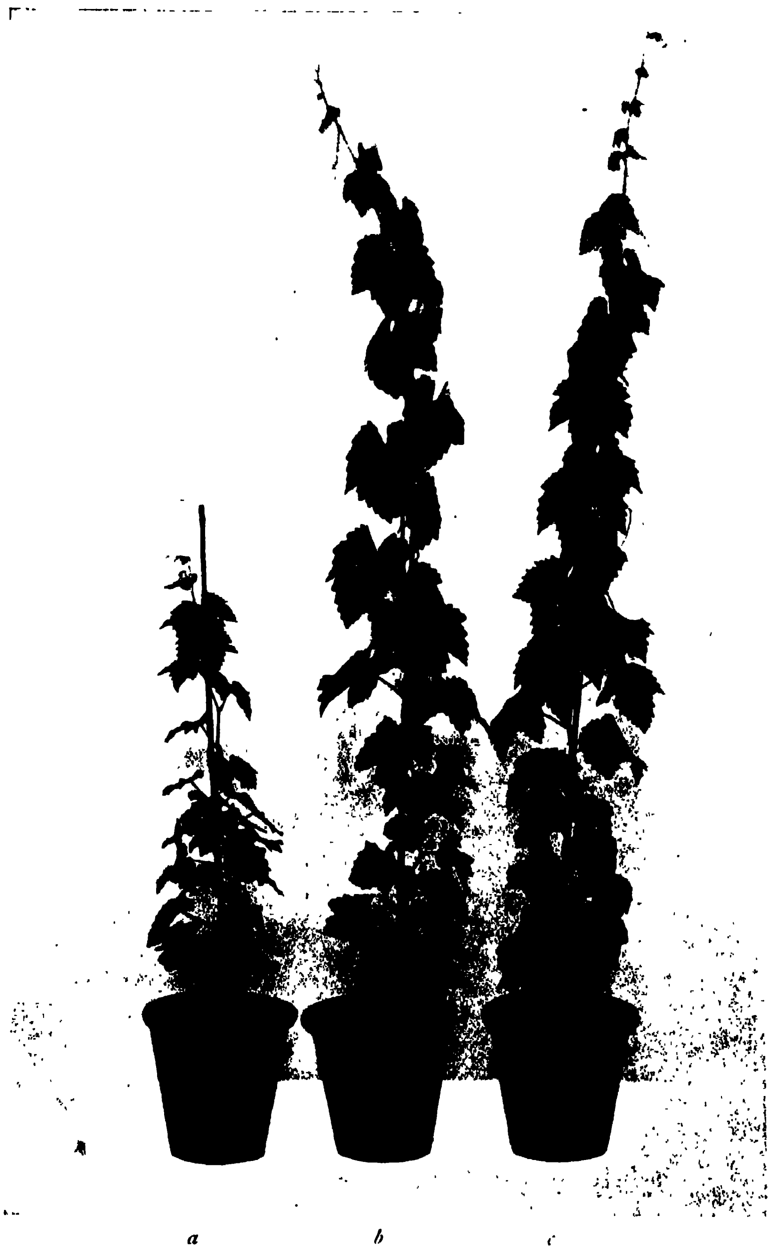


FIG. 7.—Vines growing in vine-sick soil : (*a*) untreated sick soil ; (*b*) the same soil steamed ; (*c*) treated with formaldehyde.

states that for the past five years he has fed his chrysanthemums with gas tar or coal oil, and has in consequence obtained more vigorous plants with a darker green foliage and brighter flowers of greater substance. He adopted this practice in consequence of the unusually good results obtained when plants received manure water made up from a heap of manure on which some gas tar had been accidentally upset.

This season we have extended our experiments on chrysanthemums, using composts and cuttings kindly supplied to us for the purpose by Mr. Cragg, of Merrivale Nurseri and Mr. Norman Davis, of Framfield.

The cuttings were struck directly they arrived, but marked differences were observed in the order of rooting; as a rule, the untreated soil proved the best. Thus the varieties, "Mrs. A. T. Miller," "F. S. Vallis," "Francis Jolliffe," "White Queen," and "David Ingamells," rooted most rapidly in the untreated soil and began to grow away while the others were yet standing still. "Master James" rooted most quickly in the steamed soil, and "Phœbe" in the soil treated with calcium sulphide. This effect is no doubt very variable, like the germination effects, and is being further studied; so far our results do not favour partial sterilisation of the soil in which cuttings are to be struck.

But by the middle of July most of the varieties were doing better on the partially sterilised than on the untreated soils, having larger leaves, deeper green colour, and better roots. This is seen in Fig. 8. Later on the plants were fed with a mixture containing equal parts of sulphate of potash, superphosphate and nitrate of soda, one ounce being dissolved in a gallon of water used for watering. Thus all the plants received approximately the same amount of food; their treatment was also alike in all other respects. At flowering time marked differences began to appear, the flowers grown on the untreated soil being usually later, of less substance, and of less brightness than those grown on the partially sterilised soils. How far the additional size and substance of the flowers will turn out to be general can only be ascertained by repeated trials with a large number of plants. As we only had five plants in each set for each variety, *i.e.*, five on untreated soils, five on steamed soils, &c., we do not wish to lay too much stress on this point; it is significant, however, that the earlier flowering is commonly produ on partially sterilised soils whatever the plant; we reg observed it with tomatoes and cucumbers. It is of co e practical importance, inasmuch as it proves that th al growth does not lead to rankness and delayed flow fruiting.

The results with the different varieties are summarised below:—

Variety.	Treatment of Soil which gave the best results			
	June 20th.	July 18th.	Aug. 31st.	Flowering Time.
F. S. Vallis . .	All alike .	Steam . .	Steam . .	Steam: here flowers are brightest, of deepest colour and largest
Reginald Vallis.	Steam . .	,,	,,	Steam: here flowers are brightest, of deepest colour and largest
David Ingamells	Calcium sulphide	Toluol . .	Calcium sulphide	Calcium sulphide: here flowers are brightest, of deepest colour and largest
Phœbe . . .	Calcium sulphide	Untreated .	Untreated .	Untreated: flowers out first
White Queen .	Untreated .	Formaldehyde	Formaldehyde	Formaldehyde: flowers best
Master James .	Steam . .	Formaldehyde	Steam . .	Steam: flowers best in size and brightness
Mrs. A. T. Miller	Untreated .	All alike .	,,	Not much difference, but steam best
Frances Jolliffe .	Untreated .	All alike .	,,	Flowers out first on untreated, but best on steamed soil

The order of merit did not alter after August 31st, except in the case of "Phœbe," where the plants on soils treated with formaldehyde subsequently came out best, followed by those on soils treated with calcium sulphide. For five out of the eight varieties the steamed soils proved best, the three exceptions being "White Queen," the plants of which became very yellow on the steamed soils in the early days of June and did not assume their proper colour till the end of July, and remained permanently behind the rest; "David Ingamells," where the flowers were rather late on the steamed soil, but very good when they came; and "Phœbe," where the plants on the soils treated with formaldehyde and calcium

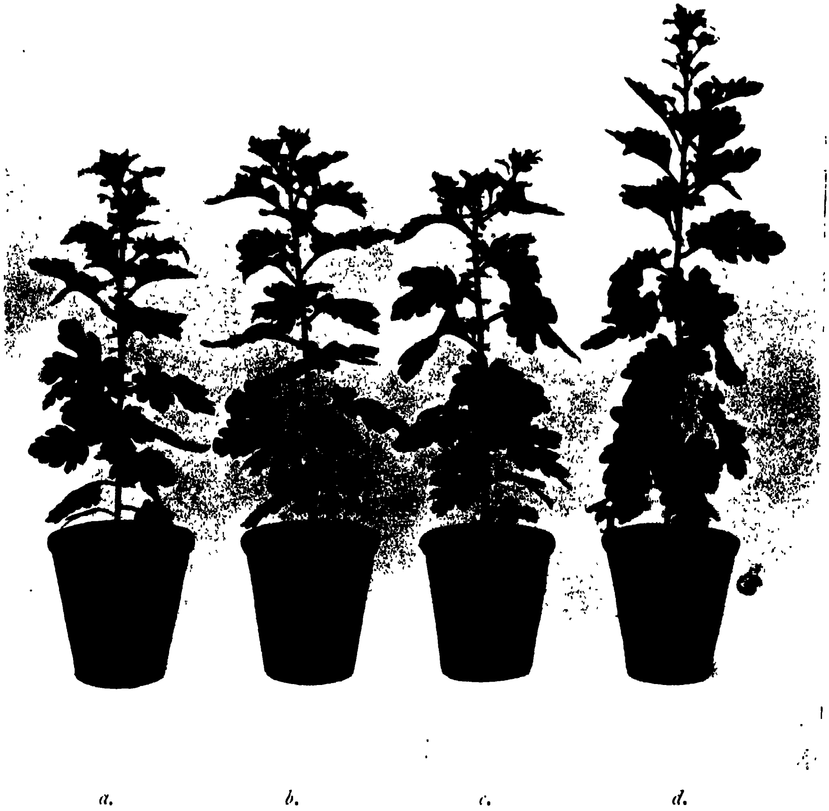


FIG. 8A.—Chrysanthemums (*David Ingamells*) in (*a*) compost treated with formaldehyde; (*b*) untreated; (*c*) steamed; (*d*) treated with calcium sulphide.

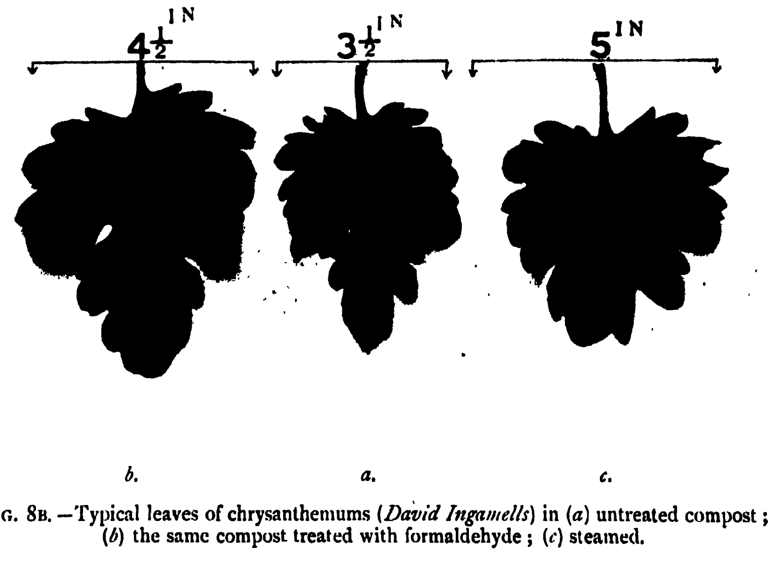


FIG. 8B.—Typical leaves of chrysanthemums (*David Ingamells*) in (*a*) untreated compost; (*b*) the same compost treated with formaldehyde; (*c*) steamed.

sulphide did not excel those on the untreated soil till September, and there was very little difference even then.

Ferns.—The advantages of heating the soil in the case of ferns are that the soil is left free of mosses, algæ, and other forms that would compete with the development of the spores of the fern, and also that more food is produced for the young plant. A marked improvement in growth is effected.

Peas.—Seeds of "Queen Alexandra" and "Dorothy Eckford" were sown in untreated, steamed, and toluol-treated soils, but no marked difference in size or colour could be observed.

Tobacco.—The germination of the seed was retarded to an extraordinary extent in the steamed soil, and the young plants for a long time were behind those on the untreated soil. In the end they caught up, but there was no final advantage in the steaming. We understand that different results are obtained in the United States and in the Transvaal, where steaming the soil is found to improve the growth of the plants considerably.

SEED ANALYSES: THEIR INTERPRETATION AND USE.

S. F. ARMSTRONG.
School of Agriculture, Cambridge.

The Importance of Seed Analysis.—Briefly stated, the importance of having seeds tested under uniform scientific conditions is based on the following facts:—

(*a*) Seeds constitute *by far the most variable material* the farmer has to purchase.

(*b*) Seeds are at the same time—weight for weight—the *most costly of all the farmer's purchases.*

(*c*) The entire success or failure of a crop (and even of succeeding crops) may be wholly determined by the kind or condition of the seed sown.

It is especially the first of these facts (*a*) which makes the matter of seed testing almost an essential one to the modern agriculturist, who cannot afford to leave any doubtful point to chance.

Variability in Quality of Seeds.

A little consideration will enable one to realise that there are a large number of causes which will always contribute to the variation in quality of seeds. A few of the principal causes may be mentioned.

1. *Causes of Variation in the Purity of Seeds.*—It is evident that the purity of the bulk of any kind of seed will be largely decided by such points as mode of production, method of harvesting, nature and extent of cleaning processes, &c. Such crops as the common cultivated clovers are seldom or never grown entirely free from weeds, and the seeds of the latter are necessarily harvested with the useful seed. Some kinds of these weed seeds may be entirely removed by screening processes, *e.g.*, the seeds of the European clover dodder. Other kinds, however, it is well-nigh impossible to separate without removing the best of the pure seed, *e.g.*, cut-leaved geranium in red clover, or sheep's sorrel in white clover.

Some seeds, *e.g.*, Meadow Foxtail, are often gathered by hand, and in this process various other kinds of seeds get introduced into the bulk either through ignorance or carelessness.

Even such seeds as those of the Rye-grasses and Cocksfoot, which are commonly grown as "pure" crops, and almost free from weeds, nevertheless contain chaffy material, which may only be partially removed afterwards by cleaning. Indeed, most kinds of grass seeds must always include a considerable proportion of chaffy material and *débris.* Apart, therefore, from any consideration of possible adulteration, such incidental impurities as the foregoing must always cause commercial samples of seeds to vary considerably in value.

2. *Causes of Variation in the Germination Capacity of Seeds.*—The more important causes to be noted here are the following:—

(*a*) *Maturity of the seed* at the time of harvesting. In many cases a large proportion of the seed is harvested more or less unripe. It is, indeed, impossible to obtain *all* the seed from a plant at any time in a fully ripe condition. The embryo in a partially ripened seed may be able to show signs of activity when sown, or it may be quite incapable of growth. It seldom gives rise to a normal vigorous seedling.

(*b*) *Climatic conditions* and *exposure* during harvest time. Even good, well-matured seed is often seriously damaged by wet unfavourable weather between the time of cutting and storing.

(*c*) *Age of Seed.* All stocks of seed are not cleared out regularly each season. The conditions of demand and supply are naturally irregular. Some seed is kept over from one season to another. But the vitality of such seed will generally be somewhat lower each year, and this vitality can only be known after careful tests.

(*d*) Lastly, such matters as the mode of handling seeds in cleaning, methods of storing, &c., will affect their germination capacity. Mechanical injury often occurs in the processes of threshing and cleaning. Insect pests frequently injure seeds during storage.

Many of the causes of variation in seeds are beyond control, and consequently the need for reliable tests must always exist.

Object of a Seed Analysis.

The object of an analysis of a sample of seed is not merely to arrive at its relative monetary value, though, of course, this is one important result attained. The main object should be to reveal its real value or worth for the purpose for which it is sold or bought—to determine whether it is a fit and reliable seed to sow or not—apart altogether from the question of cost. The certificate form given on p. 830 will show how the details of such an examination may be conveniently stated.

Interpretation of the Results of an Analysis.

It is very important that the farmer should understand the significance of the results of an analysis, and know on what points most emphasis should be placed in judging the value of a seed sample from an analysis.

And first, as regards the *purity* of a sample, it must be observed that a mere statement of the percentage of pure seed present is by itself quite insufficient, and may be very misleading.

Certain standards of purity have been fixed for most seeds, and it is commonly assumed that if samples come up to these standards they are satisfactory as far as purity is concerned.

But it does not follow that the purity of such samples is of a satisfactory nature. A sample of Red Clover, for example, may contain only 90 per cent. of pure seed and yet its "purity" be of a satisfactory character; another sample of Red Clover may consist of 99 per cent. of pure seed, and yet its "purity" be of a most unsatisfactory nature. The "purity" of a seed sample should be *judged*, not merely by the percentage of pure seed present, but more especially *by the nature of the impurities present.*

CERTIFICATE OF PURITY AND GERMINATION.

Messrs. ....

....

Ref. No. Label :

---

1. *a.*—PURE SEED (Purity)..per cent.
b.—Sand, Chaff, etc...................................per cent.
c.—Seed of other cultivated plants .... "
d.—Weed Seed .... "
Total impurities.....................per cent.

100·0 per cent.

Seed of other cultivated plants consists chiefly of :—

....

....

The chief weed seeds present are :—

....

....

2. WEIGHT of 1,000 pure seeds ....Gram.
3. GERMINATION of the pure seed at °C. :—
a.—Germinated in days per cent.
b.— " " " "
c.—Hard seeds.. "
d.—Dead " .... "

100 "

PURE AND GERMINATING SEED (Real Value) = $\frac{\text{Purity X Germin.}}{100}$ = per cent.

REMARKS :..

....

Analyst.. Date..

The *Impurities* found in seeds may be conveniently arranged into three groups, as is shown in the certificate form above :—

1. Non-living materials, as chaff, dirt, &c.
2. Seeds having some cultural value under suitable conditions.
3. Seeds of plants either useless to the farmer or positively harmful to the growth of agricultural crops.

Impurities of the first kind are not of a serious nature. They simply reduce the value of the bulk by replacing just so much of the useful pure seed. Incidentally, of course, if the proportion of such impurities is high, it shows that a sample has received little or no attention in cleaning, and so gives rise to suspicion of the seed in other respects.

Impurities of the second kind are usually undesirable, though they may be of a species more costly than the pure seed itself. The presence of a small percentage of Perennial Red Clover or Meadow Fescue seed in a sample of Tall Oat Grass seed would certainly not reduce the value appreciably, because not only is the commercial value of the three species nearly the same, but each is generally used for the same purpose.

The presence of Black Medick seeds in samples of Red Clover or Lucerne would be more undesirable, partly because of the difference in commercial value, but chiefly because of the smaller value of the plant in growth, duration, &c.

When, however, a considerable quantity of Yellow Suckling Clover occurs in White Clover, or Perennial Rye-grass in samples of Meadow Fescue or Meadow Foxtail, then the value of the bulk is considerably lessened.

The use or uselessness of seeds of other cultivated plants which happen to be present will depend largely upon the use to which the pure seed is to be put.

It is especially upon the *nature of the weed seed impurities* that the farmer should fix his attention in judging of the "purity" of a sample from an analysis. Weed seeds are always useless, and frequently lead to serious difficulties and loss. There can be no greater folly than the deliberate sowing of seeds which must lead to loss through increased labour and diminished crops. And here it must be urged that even a very small percentage of noxious weed seeds is not to be lightly ignored. A great many farmers perhaps even to-day would be disposed to treat with contempt the statement that 1 per cent. of weed seeds in the seed sown may possibly ruin a crop.

The following table has been compiled to show what 1 per cent. by weight of certain common weed seeds really represents in number of weed seeds per pound of the bulk.

TABLE I.—Showing what "*one per cent. by weight*" of some common weed seeds represents when stated as approximate number of weed seeds per pound.

Species of Weed Seed.	Approximate number in 1/100 pound (or in 1 lb. of seed as purchased).
Creeping Buttercup (*Ranunculus repens* L.)	2,900
Red Field Poppy (*Papaver Rhœas* L.)	40,000
Charlock (*Sinapis arvensis* L.)	1,980
Shepherd's Purse (*Capsella Bursa-pastoris* Moench.)	45,000
Field Pansy (*Viola tricolor* L.)	6,700
White Campion (*Lychnis vespertina* Sibth.)	3,500
Chickweed (*Stellaria media* Cyrill.)	12,000
Mouse-ear Chickweed (*Cerastium vulgatum* L.)	36,000
Dove's-foot Geranium (*Geranium molle* L.)	4,500
Cut-leaved ,, (*G. dissectum* L.)	1,900
Wild Carrot (*Daucus Carota* L.)	4,400
Field Madder (*Sherardia arvensis* L.)	2,500
Ox-eye Daisy (*Chrysanthemum leucanthemum* L.)	11,000
Stinking Mayweed (*Anthemis Cotula* L.)	12,800
Scentless ,, (*Matricaria inodora* L.)	11.600
Wild Chamomile (*Matricaria Chamomilla* L.)	79,000
Groundsel (*Senecio vulgaris* L.)	21,800
European Clover Dodder (*Cuscuta Trifolii.* Bab.)	18,000
Chilian Dodder (*Cuscuta racemosa* Mart.)	7,300
Self-heal (*Prunella vulgaris* L.)	6,800
Rib-grass (*Plantago lanceolata* L.)	3,000
Hoary Plantain (*P. media* L.)	8,500
Goosefoot or Fat-hen (*Chenopodium album* L.)	6,600
Curled Dock (*Rumex crispus* L.)	3,200
Sheep's Sorrel (*R. Acetosella* L.)	10,500
Yorkshire Fog (*Holcus lanatus* L.) (in glumes)	8,900
,, ,, ,, (without glumes)	12,700
Wavy Hairgrass (*Aira flexuosa* L.)	8,400
Tufted ,, (*A. cæspitosa* L.)	25,500

The figures given in the above table should amply serve to show the serious nature of the presence of even small proportions of weed seeds. To illustrate this point further, let us suppose that a sample of Red Clover seed contains 1 per cent. by weight of the common European Clover Dodder. Table I. shows that each pound of the clover seed will contain some 18,000 seeds of the dodder. If twenty pounds of such seed be sown per acre, it follows that approximately 360,000 dodder seeds, or 74 per square yard, will be sown over the same area. If only 0·1 per cent. of dodder be present, no less than seven dodder seeds per square yard will be sown with the same weight of seed per acre. In the case of such weeds as the Red Poppy or Shepherd's Purse, the above figures would have to be more than doubled.

Table II. will serve to show that in the case of many of the most noxious weed seeds 1 per cent. by weight really represents a much higher percentage by number of individuals.

TABLE II.—Showing what "*one per cent. by weight*" of some common weed seeds represents when stated as percentage by number for different commercial seeds in which they occur.

One per cent. *by weight* of the following weed seeds:	Represents the percentages *by number* given below: In Red Clover.	In Alsike or White Clover.	In Rye Grasses.	In Meadow Foxtail.
Creeping Buttercup ..	—	—	1·2	0·6
Red Field Poppy	17·3	5·5	—	—
Shepherd's Purse	19·8	6·2	—	—
Field Pansy	3·0	—	—	—
White Campion	1·5	—	—	—
Chickweed	5·2	1·6	—	—
Mouse-ear Chickweed ...	—	5·0	—	—
Wild Carrot	1·9	—	—	—
Field Madder	1·1	—	—	—
Ox-eye Daisy	4·8	1·5	—	—
Stinking Mayweed	5·5	1·7	—	—
Scentless ,, ...	5·0	1·6	—	—
European Clover Dodder	7·6	2·4	—	—
Chilian Dodder	3·2	—	—	—
Self-heal	2·9	0·9	—	—
Rib-grass	1·5	—	—	—
Hoary Plantain	3·7	1·2	—	—
Goosefoot or Fat-hen ...	2·8	0·9	—	—
Curled Dock	1·4	—	—	—
Sheep's Sorrel	4·6	1·5	4·4	2·2
Yorkshire Fog (in glumes)	—	—	3·6	1·8
Do. (without glumes)	—	—	5·1	2·5
Tufted Hairgrass	—	—	—	5·0

Such considerations as these should serve to warn the farmer of the danger of ignoring small proportions of weed impurities. If one only realises what 1 per cent. of a certain weed indicates, there will be little fear of one using still more inferior samples containing 5 per cent., 10 per cent., or even larger quantities of weed seeds. And such samples are more frequently used at present than is generally supposed.

In considering the "purity" of any seed, therefore, we do well to remember that its value is affected at least as much (and often much more) by the nature of the impurities as by *their actual quantities.* In other words, in choosing between two or more samples of the same kind of seed, the best for the farmer will not necessarily be the sample containing the highest percentage of pure seed, but the sample containing the lowest proportion of noxious weeds—assuming always that the samples are equal in other respects, and that the proportion of pure seeds is not below a given figure.

To arrive at the cultural value of any seed, it is necessary not only to know the percentage of pure seed present, but also the germination capacity of the latter. And here again it is important to urge that it is not merely the proportion of seeds which manage to germinate, but *rather the nature or quality of the germination,* which is the real measure of the value of the seed. For example, a sample of Perennial Rye-grass, which germinates up to 90 per cent. in the course of sixteen days, is not nearly so good as a sample which gives a germination of 90 per cent. in six days, other things being equal.

Immature seeds or old seeds may germinate after a fashion, but frequently the process is so slow and feeble as to indicate little or no cultural value.

It is generally agreed that the formula:

$$\frac{\text{Percentage Purity} \times \text{Percentage Germination}}{100}$$

gives the real or cultural value of any seed. The main purpose of this article is to show that while this formula is true in theory, yet in practice an additional statement is required indicating the nature of the impurities present and the quality of the germination process. It is on such points as these that seed stations can give reliable information. The numerous seed impurities are readily recognised by the expert, though most of them would be unobserved or unknown to the farmer. Moreover, the quality of the germination process is precisely indicated under the uniform conditions which can be secured at such an institution.

THE FEEDING OF CATTLE.

In a paper read at the Annual Meeting of the British Association at Dundee, 1912, Mr. John Ross, Millcraig, Alness, one of the most successful feeders and exhibitors of fat cattle in Great Britain, gave an account of his methods and outlined his views on the subject of the feeding of cattle.

The paper cannot fail to be of great interest to those concerned with the fattening of cattle, and a summary of the principal points dealt with is given below.

Selection of Cattle.—In selecting cattle, no pains should be spared to secure the very best animals obtainable. The ideal system is for the feeder to rear his own cattle, as he then has complete control from the very commencement, but if circumstances do not permit of this, stores should be bought preferably at from 12 to 15 months old, the object being to turn out good fat cattle at from 20 to 24 months old, which are likely to provide the class of beef demanded by the modern consumer.

Details of Management.—Next to the selection of cattle, probably the most important factor which determines success is the attention given to practical details of management. The farmer himself must give close personal supervision, and see that the whole routine of feeding, &c., goes on smoothly from day to day and with absolute regularity. It need hardly be said that this cannot be secured unless the cattleman is thoroughly competent, painstaking, and enthusiastic, whether preparing animals for show or simply for the ordinary market.

The time-table given below is the one recommended by Mr. Ross. Feeding should begin with the same animal, and the same order of feeding be adhered to at every meal.

6 *a.m.*—First feed of 2 to 4 lb. of cake. Immediately the cake has been eaten give 25 lb. turnips,* cut into "fingers." These should have been prepared the previous evening.

7 *a.m.*—Clean out byres and boxes, and bed up comfortably. Fill hampers with the "chop" prepared the day before.

9 *a.m.*—Feed the "chop." The cattle may now be groomed, and then left until the afternoon feed. The turnips for the

---

* "Turnips" includes yellow turnips and swedes.

afternoon should be cut, and the "chop" for the following day prepared.

1 *p.m.*—Give a second feed of turnips, followed by "chop" as in the morning. If the cattle are being forced, the turnips may be preceded by a feed of cake as before.

6 *p.m.*—Give dry cut hay to last through the night.

Feeding of Calves.—Young calves intended for show purposes are not weaned till about nine months old, and in addition to the mother's milk, grain, &c., should receive a little linseed cake. The latter, though high in price at the present time, is specially suited to calves, and may profitably be given in moderate quantities. In late summer, when the grass begins to fail, cut tares, beans, or clover will prepare the animals for weaning—a most critical time—when liberal feeding is necessary. The cake will require to be supplemented with a few early turnips, which should be given in moderate quantities along with a mixture of chopped hay or oat straw and meal or bran. The mixture should be damped with treacle-water, and prepared 24 hours before feeding.

Winter Fattening of Stores.—If the animals have been brought forward well on grass, and housed in September at, say, 19 months old, the following rations would be given to prepare the cattle for the Christmas market:—

Roots.—Not more than 50 lb., divided into two feeds.

Hay.—From 5 to 7 lb., given chopped.

Straw.—All chopped: 7 to 8 lb., mixed with 6 or 7 lb. of "draff" or "dreg" (distillers' grains), and from 3 to 5 lb. of meal, all damped either with "burnt ale" (a distillery waste product), or treacle-water. This mixture is allowed to stand 24 hours before being used.

Cake.—Linseed cake, Soya bean cake, and Bombay cotton cake are mixed in about equal proportions and from 2 to 4 lb. per head daily are given. The proportion of linseed cake is increased as the animal fattens. Animals such as those under consideration will, when 20 to 24 months old, weigh 11 to 13 cwt. live weight.

Young cattle, 10 or 11 months old, intended for fattening off in June at the age of 16 or 17 months, would be given much the same ration as that described above for older cattle, as they have to grow as well as to fatten. If, however, they are not to be finished in summer, but simply grazed for fattening in the following autumn, only about half the quantity of cake would be given.

It will be noticed that a comparatively small amount of concentrated food is used, home-grown food being chiefly relied upon; thus turnips, hay, straw, and meal are used for winter food, and grass, tares, beans, &c., for summer, while full advantage is also taken of the cheap distillery by-products available in the case in question.

At one time the practice was to prepare all home-grown grain by boiling and then to mix it with cut straw or hay. The cooking of the food was thought to be a great advantage, but as labour and coals have become more expensive the practice followed at present is simply to steep the meal in cold water for 24 hours.

Buildings.—The increased cost of labour has forced into greater prominence the necessity for arranging the buildings —straw barn, turnip shed, mixing house, byres, covered yards, &c.- -in the most convenient proximity to one another. The initial outlay on the buildings may be considerable, but the continual daily saving in work far outweighs any reasonable expense incurred in their erection. Where breeding, rearing, and fattening are all carried on, byres, boxes, and covered yards are all needed. Boxes affording comfortable resting and feeding quarters, and some room for exercise, are most convenient for finishing the feeding period, while byres are best for cows and calves.

In conclusion it may be observed that the turnips and straw are of a higher quality than those available for most English feeders, and probably the average feeder in England could not rely to quite the same extent on home-grown foods, but the success which has been obtained in this particular case must be attributed mainly to (1) the securing of the right class of cattle, and (2) the careful attention given generally to details of management, and in particular to securing absolute regularity of feeding and the maximum amount of comfort and quietude for the animals.

IMPORTS OF AGRICULTURAL PRODUCE IN 1912.

THE total value of the principal articles of food imported into the United Kingdom in 1912 was £206,121,000, as against £190,690,000 in 1911, £189,418,000 in 1910, and an average of £182,365,000 in the seven years 1903–1909. These figures represent the value (cost, insurance, and freight), as declared to the Customs officers at the port of arrival, of the grain and flour, meat and animals for food, butter, cheese, eggs, condensed milk, fruit and vegetables, hops, lard, and margarine, which may be grouped together as agricultural food products in the sense that they compete more or less directly with the home supply.

The increase in value during the past year as compared with 1911 was mainly due to the increased cost of the grain and flour imported, the total value of the items included under the general heading of grain and flour amounting to £88,507,000, as compared with £75,761,000 in 1911. The imports of dairy produce (butter, cheese, and eggs together) showed a slight increase, viz., from £39,708,000 in 1911 to £40,163,000 in 1912. On the other hand, the value of meat (of all kinds) imported was less than in 1911 by £624,000.

Cattle and Beef.—The past year has seen a further decline in the number of live cattle imported into the United Kingdom, the number received being 48,912, or about one-tenth of the imports in 1894. Only two countries (apart from the Channel Islands) participate in this trade, viz., the United States and Canada. The exports to this country from both these countries showed large decreases in 1912 compared with 1911.

The imports of beef, chiefly chilled and frozen, although not sufficient to compensate for the decrease in the imports of live cattle, again showed a large increase, and amounted in the aggregate to 8,014,805 cwt., the highest figure yet recorded. The imports of fresh beef were larger than in 1911, owing to an increased supply from Denmark. The main source of supply of chilled and frozen beef is Argentina, from which country 3,871,140 cwt. of chilled beef, and 2,723,755 cwt. of frozen beef were received. A noticeable feature during recent years has been the extension of the chilled beef trade (representing the better class of meat), the total imports of which from all countries, although showing a slight decrease in quantity from 3,933,037 cwt. in 1911 to 3,884,890 cwt. in 1912, increased in value from £6,304,000 in 1911 to £7,311,000 in 1912. Another point in connection with the chilled beef trade which is worthy of mention is the continuous decline in the supplies from the United States. In 1912 the very small amount of 4,271 cwt. was received from this source. The frozen beef imports, after remaining fairly steady for several years, increased by £1,540,000 in 1912. The imports of frozen beef from Australia, New Zealand, and Uruguay, after declining in 1911 from the imports of 1910, showed large increases in 1912, and more than regained the ground they had lost (except in the case of New Zealand). The chilled beef from all sources averaged 37*s.* 8*d.* per cwt., compared with 32*s.* in 1911, while the frozen beef was several shillings lower, viz., 30*s.* 10*d.* per cwt., as against 28*s.* in 1911.

The weight of beef represented by the imports of cattle may be estimated at 320,000 cwt., which, added to the imports of fresh and refrigerated beef, make the total receipts of meat of this class from abroad in 1912 8,335,000 cwt., or nearly 20½ lb. per head of the population. In 1911 the figures were 8,670,000 cwt., representing 21½ lb. per head; in 1910, 8,432,000 cwt., or 20¾ lb. per head; in 1909, 8,217,000 cwt., or 20$\frac{4}{10}$ lb. per head; in 1908, 8,115,000 cwt., or 20⅖ lb. per head; in 1907, 8,806,000 cwt., or 22⅓ lb, per head; and in 1906, 9,170,000 cwt., which was equal to 23½ lb. per head.

Sheep and Mutton.—The number of live sheep imported rose from 427 in 1910 to 47,673 in 1911, but dropped to 15,430 in 1912. The quantity of mutton imported also showed a decrease from 5,330,000 cwt. in 1911 to 5,022,000 cwt. in 1912. Nearly all of it comes in the form of frozen mutton, chiefly from New Zealand (2,165,000 cwt.), Australia (978,000 cwt.), and Argentina (1,589,000 cwt.). The quantities received from Australia and Argentina were less than in the preceding year, but the receipts from New Zealand showed an increase of some 184,000 cwt.

The weight of meat represented by the sheep received alive may be estimated at 8,300 cwt., which, added to the imports of fresh and refrigerated mutton, make the total receipts 5,030,000 cwt., this being equal to 12⅓ lb. per head of the population. In the three previous years the total receipts, alive and dead, were 5,363,000 cwt., 5,406,000 cwt., and 4,766,000 cwt. respectively, or about 13¼ lb., 13⅓ lb., and 12 lb. per head of the population.

The declared value of the fresh mutton was 50*s.* per cwt., or about the same figure as in 1911, 1910, and 1909, and 5*s.* less than the values in the three years 1906–8.

Rabbits.—The receipts of fresh rabbits, chiefly from Belgium, amounted to only 43,915 cwt., and the bulk of the rabbit supply was composed of frozen rabbits from Australia and New Zealand, the former country sending 314,343 cwt., and the latter 72,657 cwt. The value per cwt. of these frozen rabbits was, however, only a little over one-third of the value per cwt. of the fresh Continental supply.

IMPORTS of Live and Dead Meat.

Description.	Quantity.		Value.	
	1911.	1912.	1911.	1912.
	Number.	Number.	£	£
Cattle	200,398	48,912	3,776,404	982,958
Sheep	47,673	15,430	74,174	23,793
Total live animals ...	—	—	3,850,578	1,006,751
	Cwt.	Cwt.		
Beef, fresh & refrigerated	7,361,094	8,014,805	11,134,482	13,692,059
,, salted	90,303	54,269	171,072	114,225
Mutton, fresh and refrigerated	5,330,070	5,021,529	9,576,446	9,698,785
Pork, fresh & refrigerated	452,932	312,739	1,120,764	830,743
,, salted	236,549	213,238	292,063	270,265
Bacon	4,868,738	4,634,099	14,463,414	14,555,585
Hams	954,811	897,873	2,927,600	2,720,369
Meat unenumerated—				
Fresh and refrigerated	726,091	832,083	1,315,447	1,457,761
Salted	88,357	87,844	123,286	114,168
Meat, preserved	946,244	869,588	3,037,107	3,084,785
Rabbits, dead	525,666	430,925	712,600	617,168
Total dead meat ...	21,580,855	21,368,992	44,874,281	47,155,913
Poultry and game ...	—	—	997,324	935,627

Bacon.—The imports of bacon in 1912 (4,634,099 cwt.) declined slightly compared with 1911, but were still much above the imports of 1910. Denmark sent 2,318,708 cwt., as compared with 2,122,087 cwt. in 1911 and 1,794,416 cwt. in 1910; and in these three years the United States sent 1,698,347 cwt., 1,817,835 cwt., and 1,306,921 cwt., and Canada 387,401 cwt., 615,807 cwt., and 411,935 cwt.

The declared average value was 62*s.* 10*d.* per cwt., as compared with 59*s.* 5*d.* in 1911, 69*s.* 4*d.* in 1910, and 59*s.* 8*d.* in 1909.

Poultry and Game.—Poultry is chiefly received from Russia, the United States, France, and Austria-Hungary; the total value in 1912 was a decrease compared with the total of the preceding year, but was above the figure of 1910. The value of the imported game was £89,431.

Total Imports of Meat.—Converting the live animals into their equivalent weight of meat and adding the total imports of dead meat of all kinds (excluding poultry and game), it appears that the quantity available, in addition to the home supply, was some 21,697,000 cwt., as compared with 25,787,000 cwt. in 1911, 21,401,000 cwt. in 1910, 21,479,000 cwt. in 1909, 22,205,000 cwt. in 1908, and 22,586,600 cwt. in 1907. This was not entirely consumed in this country, as there was a small re-export amounting to 336,868 cwt.

The total value credited to the different kinds of live and dead meat, including poultry and game, was £49,098,000, as compared with £49,722,000 in 1911, £48,879,000 in 1910, £47,623,000 in 1909, £49,448,000 in 1908, £51,888,000 in 1907, and £52,026,000 in 1906.

IMPORTS of Dairy Produce, Margarine, and Eggs.

Description.	Quantity.		Value.	
	1911.	1912.	1911.	1912.
	Cwt.	Cwt.	£	£
Butter	4,302,692	4,005,159	24,600,619	24,354,193
Margarine	944,405	1,352,427	2,461,325	3,514,045
Cheese	2,348,326	2,308,799	7,140,042	7,414,126
Milk, condensed ...	1,155,242	1,211,793	2,020,991	2,215,354
	Great hundreds.	Great hundreds.		
Eggs	19,057,897	19,085,052	7,967,555	8,394,524

Butter.—About three-quarters of the butter supplied to this country from abroad comes from the Continent of Europe, Denmark (1,618,048 cwt.), Russia (683,650 cwt.), France (246,652 cwt.), Sweden (335,014 cwt.), and Holland (113,716 cwt.) being the chief contributors. Almost the whole of the remainder is received from Australia (541,253 cwt.) and New Zealand (349,012 cwt.).

The quantity of butter received was below the imports of the last few years; the value was 121*s.* 7*d.* per cwt., as compared with 114*s.* 4*d.* per cwt. in 1911, and 108*s.* 2*d.* in 1906, the year in which the maximum amount yet recorded was imported.

Cheese.—The supply of cheese showed a small decrease. More than half the imports come from Canada, but the imports from this source decreased from 1,607,064 cwt. in 1910 to 1,473,275 cwt. in 1911, and to 1,352,570 cwt. in 1912.

Eggs.—Up to 1909 the supply of eggs had been declining for several years, but the increase in 1910 and 1911 was continued in 1912.

IMPORTS of Grain and Flour.

Description.	Quantity.		Value.	
	1911.	1912.	1911.	1912.
	Cwt.	Cwt.	£	£
Wheat	98,067,787	109,582,539	38,909,816	46,449,605
,, meal and flour ...	10,065,132	10,189,476	5,277,043	5,518,484
Barley	24,545.420	20,126,294	8,266,145	7,877,961
Oats	18,273,037	18,300,700	5,390,970	6,338,565
Oatmeal	835,985	832,218	598,405	602,604
Maize	38,602,330	43,877,338	10,713,183	13,593,216
,, meal	643,810	610,310	224,415	240,827
Peas	2,196,094	2,574,707	1,012,862	1,291,602
Beans	1,029,101	1,256,741	375,333	470,847
Other corn and meal ...	12,412,380	12,957,020	4,992,771	6,123,500
Total	206,671,076	220,307,343	75,760,943	88,507,211

Grain and Meal.—The decline in the imports of wheat which took place in 1911 was not maintained in 1912, and last year's imports of wheat are the largest yet recorded. The leading sources of supply were Russia (9,005,000 cwt.), India (25,379,400 cwt.), Canada (21,551,100 cwt.), Argentina (18,783,700 cwt.), United States (19,973,994 cwt.), and

Australia (11,908,505 cwt.), the noteworthy features of the wheat trade in 1912 being a drop in the imports from Russia and Australia, and increases in the supplies from the United States, Argentina, India, and Canada.

The receipts of flour were slightly greater than in 1911. The supplies from the United States decreased, while those from Australia and Canada increased. The exports of flour from this latter country to the United Kingdom are steadily increasing.

The imports of barley dropped to some extent, but not to the level of 1910. The principal contributors were Russia (3,664,900 cwt.), Turkey (3,524,100 cwt.), Roumania (1,591,900 cwt.), and the United States (797,320 cwt.).

Oats amounting to 18,300,700 cwt. were imported in 1912, this figure being slightly higher than in 1911 and 1910. Russia (3,305,200 cwt.) and Argentina (7,657,500 cwt.) were the two chief sources of supply. Germany furnished 2,009,500 cwt., and Canada 1,963,100 cwt., while the imports from the United States were 2,160,900 cwt.

The supply of maize (43,877,338 cwt.), although larger than in the preceding four years, did not reach the 1907 total, when the imports amounted to 53,379,950 cwt. Compared with 1911 there were decreases in the imports from Russia, Roumania, the United States, and Canada, and a huge increase from Argentina, viz., from 3,648,080 cwt. in 1911 to 28,795,830 cwt. in 1912.

Fruit and Vegetables.—Potatoes were received in larger quantities than has been the case since 1908. The exports from all countries increased in 1912 compared with 1911. The chief countries in this trade are Germany, Holland, France, and the Channel Islands. The other vegetables imported are mainly onions and tomatoes.

With regard to fresh fruit, there was a falling off in the imports of cherries, currants, gooseberries, grapes, lemons, nuts, plums, and strawberries. There were increases in the imports of apples, pears, apricots, peaches, bananas, and oranges.

Hops were imported to the extent of 243,886 cwt., as against 169,184 cwt. in 1911, but at a much higher price.

Wool.—As regards wool, the quantity imported increased slightly over that of the previous year, and the average price remained about the same, viz., 10*d.* per lb., w[illegible]s about the level at which it stood in 1906 and 1907. The bulk of the supply came, as usual, from our Colonies and Possessions, viz., Australia (285,061,874 lb.), New Zealand (184,240,455 lb.), British South Africa (120,604,699 lb.), and India (55,374,901 lb.). The total receipts were 806,855,687 lb., as compared with 794,514,850 lb. in 1911.

The re-exports of foreign and Colonial wool were 340,107,313 lb., as against 304,207,981 lb. in 1911, so that the balance of wool (other than home produce) remaining for manufacture in this country was 466,748,000 lb., as compared with 490,307,000 lb. in 1911, 463,929,000 lb. in 1910, and 413,326,000 lb. in 1909.

Soya Beans.—The imports of this article, the residue from which in the form of cake has assumed such importance as a feeding stuff, were 188,760 tons, of which 107,564 tons came from Russia, 65,634 tons from China, and 15,467 tons from Japan. The aggregate value was £1,567,960, and the average value per ton about £8 6*s.*

Miscellaneous.—In addition to the agricultural products already mentioned there are some articles of importance which may be referred to as of interest to the agricultural industry. The figures for these are given in the following table:—

MISCELLANEOUS IMPORTS.

Description.	Quantity.		Value.	
	1911.	1912.	1911.	1912.
	cwt.	cwt.	£	£
Wood and Timber	—	—	25,862,171	28,351,315
Tallow and Stearine	2,203,664	2,136,770	3,671,248	3,580,884
Hides:				
Dry	462,354	679,720	1,654,556	2,534,303
Wet	658,045	939,839	2,091,887	3,142,099
Manures:	tons.	tons.		
Basic Slag	22,666	49,310	37,889	89,144
Bones, burnt and unburnt...	45,883	41,206	226,225	217,571
Guano	34,124	14,115	193,000	81,568
Nitrate of Soda	128,487	123,580	1,189,019	1,274,752
Phosphate of Lime and Rock Phosphate	493,415	520,270	779,706	840,996
Oil Seed Cake	338,226	385,670	1,963,644	2,487,421
	cwt.	cwt.		
Seeds, Clover and Grass ...	233,612	288,857	550,071	697,060
Flowers, fresh	—	—	241,044	220,863
	No.	No.		
Horses...	11,528	12,646	435,323	473,019

Prices.—**Some indication of the range of prices may be gathered from the average declared value of the different articles, but only to an approximate extent, as an increased** importation of a cheaper quality of any article depresses the average value, although no real change in price may have taken place. With this reservation it may be said that the record for the past year shows, on the whole, a decided increase in the prices of nearly all agricultural commodities. In fact, there were only two items which decreased in price, viz., sheep and hams. The increases per cwt. were as follows:—Cattle, £1 5*s.* 1*d.* (per head); beef, 3*s.* 11*d.*; mutton, 2*s.* 8*d.*; pork, 3*s.* 7*d.*; bacon, 3*s.* 5*d.*; butter, 7*s.* 3*d.*; cheese, 3*s.* 5*d.*; wheat and maize, 7*d.*; wheat flour, 4*d.*; barley, 1*s.* 1*d.*; and oats, 1*s.*; while the price of eggs increased by 6*d.* per great hundred. The figures for some of the principal articles are as follows:—

PRICES OF AGRICULTURAL PRODUCE IMPORTED.

Description.		1909.			1910.			1911.			1912.		
		£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Cattle	Head	17	6	5	18	6	11	18	16	10	20	1	11
Sheep	,,	1	11	10	1	15	4	1	11	1	1	10	10
Beef, fresh & refrigerated	Cwt.	1	13	6	1	13	6	1	10	3	1	14	2
Mutton ,, ,,	,,	1	12	11	1	16	3	1	15	11	1	18	7
Pork ,, ,,	,,	2	7	10	2	9	11	2	9	6	2	13	1
Bacon	,,	2	19	8	3	9	4	2	19	5	3	2	10
Hams	,,	2	15	2	3	10	3	3	1	4	3	0	7
Butter	,,	5	10	5	5	13	3	5	14	4	6	1	7
Cheese	,,	2	17	2	2	15	5	3	0	10	3	4	3
Eggs ...	Great hundred	0	8	2	0	7	11½	0	8	4	0	8	10
Wool	Lb.	0	0	9½	0	0	10¼	0	0	10	0	0	10
Wheat	Cwt.	0	9	3	0	8	4¾	0	7	11	0	8	6
,, flour	,,	0	11	6¼	0	11	6¾	0	10	6	0	10	10
Barley	,,	0	6	7½	0	5	10¾	0	6	9	0	7	10
Oats	,,	0	6	1¼	0	5	6¼	0	5	11	0	6	11
Maize	,,	0	6	2	0	5	6¾	0	5	7	0	6	2

Agricultural Exports in 1912.

The value of the agricultural articles of British production and manufacture exported amounts in the aggregate to a considerable sum, although taken individually they do not usually represent a very extensive trade. The information, available for the past year, is **summarised in the next table. The various commodities in-**

EXPORTS.

Description.		1911.	1912.
Grain and flour	£	3,573,905	4,240,633
Meat (including animals for food)...	£	1,023,361	1,101,196
Wool...	lb.	30,777,000	47,122,500
	£	1,631,791	2,359,468
Hides and undressed skins... ...	£	1,685,293	2,028,311
Manures	tons	804,322	666,399
	£	5 482,709	5,320,838
Oil-seed cake	tons	118,603	77,821
	£	722,528	548,648
Agricultural machinery (prime movers) ...		1,172,981	1,300,319
Do. (not prime movers or electrical)		1,566,868	1,605,648

Description.		Quantity.		Value.	
		1911.	1912.	1911.	1912.
ANIMALS LIVING—FOR BREEDING:		Number.	Number.	£	£
Cattle	To United States of America	772	546	25,209	19,502
	,, Uruguay	19	4	2,016	218
	,, Argentine Republic ...	243	322	20,910	48,086
	,, Channel Islands	—	—	—	—
	,, Australia	81	12	3,903	1,344
	,, Canada	136	185	5,240	13,993
	,, Other Countries	1,351	890	43,003	42,234
	Total... ...	2,602	1,959	100,281	125,377
Sheep and Lambs	To Germany	475	312	4,286	2,701
	,, United States of America	692	129	4,326	1,148
	,, Uruguay	111	58	1,191	345
	,, Argentine Republic ...	422	185	9,605	3,818
	,, Australia	72	8	1,262	480
	,, New Zealand	96	60	1,955	1,684
	,, Canada	374	21	2,283	50
	,, Other Countries	486	836	4,753	6,428
	Total... ...	2,728	1,609	29,661	16,654
Swine	To Argentine Republic ...	—	—	—	—
	,, Canada	22	11	330	180
	,, Other Countries	540	579	6,500	6,130
	Total... ...	562	590	6,830	6,310
HORSES:					
	To Netherlands	20,998	22,276	315,031	353,969
	,, Belgium	33,324	34,069	456,981	449,277
	,, France	2,993	4,709	142,128	211,115
	,, Other Countries	6,881	5,874	549,955	458,222
	Total... ...	64,196	66,928	1,464,095	1,472,583
ANIMALS OF OTHER KINDS—Not for Food		91,141	65,515	58,190	60,102

cluded under the heading of corn, grain, and flour represent a total of £4,240,633, while meat of all kinds, including live cattle, bacon, hams, poultry, and game, accounts for £1,101,196. Wool from British flocks was exported to the value of £2,359,468, while hides and undressed skins accounted for £2,028,311.

Three items of importance, viz., manures, cakes, and agricultural machinery, are included in the table, though they are not agricultural products. In the case of manures, 666,399 tons were sent from these shores, representing a value of £5,320,838; nearly one-half of this, viz., 286,864 tons, was sulphate of ammonia, while the balance was made up of 88,920 tons of superphosphate, 157,074 tons of basic slag, and 133,541 tons of other kinds of artificial manures.

As regards oil-seed cake, a substantial increase occurred in 1910, but this was not maintained either in 1912 or in 1911, and the exports of this feeding stuff seem to be declining.

Perhaps the most interesting item in the export trade, from an agricultural point of view, is that which shows the sales of breeding animals to the Colonies and foreign countries. In the table on p. 846 the particulars are given for the past two years.

In spite of the fact that the number of cattle exported showed a large decrease, there was an *absolute* increase in the value, the trade having been in much more valuable animals. The value per head in 1911 was £39 and in 1912 £64. The export of sheep was very much smaller, the decrease in the number sent to Canada, Argentina, and the United States being largely responsible for this. Horses, however, represent the largest item in this export trade, and the total value in the past year is the largest yet recorded.

The Chestnut Bark Disease.

The Chestnut Bark Disease, or Chestnut Tree Blight, appears to attack all species of *Castanea* with the exception of the Japanese variety. The disease has done considerable damage to chestnut trees (*Castanea dentata*) in the United States.

According to a report by H.M. Consul at Philadelphia, Mr. Wilfred Powell, attention was called to the disease in the United States in 1904, when it was noticed in the neighbourhood of New York. By 1911, however, it had spread into ten States, and a conservative estimate of the damage up to that year placed the loss due to its ravages at £5,000,000. In the case of New Jersey, infection is already so general that there is very little hope of saving any chestnut trees in that State. The disease is said to be beyond hope of control in the lower Connecticut Valley, and is very bad in Pennsylvania, although a Commission has been formed for the investigation and control of the disease, and the disease has been the subject of special legislation, the area of general infection now including fully one-half of the latter State.

Description of the Disease.—The disease has been found to attack practically every chestnut tree in its line of advance, and any part of trees of any age. It is caused by a fungus (*Diaporthe parasitica*, Murrill), which seems able to start only in wounds in the bark; these wounds, however, may be caused by squirrels, insects, or birds, and are so frequent that the fungus easily gains an entrance. The conditions for the growth of the fungus seem to be most favourable between the wood and the bark. Once started, it spreads rapidly, and soon girdles the part upon which it is growing. It is this characteristic of girdling which makes it especially destructive, as, though only a small amount of tissue is actually invaded by the fungus, the entire tree, branch, or twig above the affected part is killed. When a twig or branch is diseased, the spores or fruiting bodies of the fungus are washed down towards the trunk, which soon also becomes infected and girdled.

The disease is most noticeable during late spring and summer. During this period the dying or recently killed branches are easily detected from some distance on account of their discoloured foliage. The leaves on a diseased branch turn to a reddish-brown colour and finally wither, but they have a tendency to remain on the tree for some time. The burrs on infected branches usually remain on the tree during the winter following its girdling.

The diseased trees very frequently produce sprouts or "suckers" in considerable numbers. These may appear on the trunk or near the base of the tree. Such sprouts soon become infected, however, and very few survive more than two or three years.

An enlargement of the branch often occurs above the wound, and, in fact, many of the effects are similar to those produced by mechanical or insect girdling.

The diseased band is especially conspicuous on smooth bark, causing a reddish-brown discoloration, producing numerous little pustules, which break through the bark and set free a vast number of spores. These spore-masses are orange-coloured, but vary considerably in appearance, according to climatic conditions. During warm moist weather they are specially prominent, and sometimes may be seen as long, curly, yellow threads issuing from the pustules. If older portions are attacked, the discoloration and pustule formation are not so evident, as most of the pustules are produced in the fissures of the bark. The bark so attacked, when cut through, is found to be discoloured, and breaks up easily, as if rotten.

The fungus may continue to grow in the dead bark for some time. It was not generally thought to be capable of growth in the wood, but three investigators in different parts of the United States have reported finding it upon the wood during the past season.

Besides the common so-called summer spores mentioned above, the fungus produces other spores, known as the perfect or winter spores. These are darker in colour, and the pustules are less conspicuous. They are most frequently produced during the late autumn, and help the fungus to survive unfavourable weather conditions.

Preventive Measures.—Spraying appears to be of little value, and is entirely impracticable in forest areas. The method finally adopted in the United States aims at preventing the further spread of the disease from the area of general infection and destroying all diseased trees outside this area. For this purpose it may be necessary in some instances to cut down all chestnut trees, both healthy and diseased, in a belt some miles wide.

In the case of individual trees which are of considerable value, it is often possible to prolong their lives, or even to save them, by careful treatment. Diseased twigs and small branches are removed; while the trunk and larger branches are treated by carefully cutting away all diseased bark into the healthy bark round the edges of the wound. A layer of wood is also removed from beneath this bark, and the entire wound painted over with coal tar.

Provision of Technical Advice in Forestry.

The arrangements made by the Board of Agriculture and Fisheries for the administration of the grant by the Development Commission of £2,500 yearly for three years for the purpose of providing technical advice in forestry are now practically completed.

England and Wales have been divided into five districts, and an advisory officer has been attached, or will shortly be attached, to a teaching institution in each district. The duties of these officers are to advise applicants on all questions relating to the treatment of their woods. In ordinary cases no charge would be made, but where such a course appears desirable, a fee not exceeding one guinea per day for every day spent in the field may be made according to the circumstances of the case.

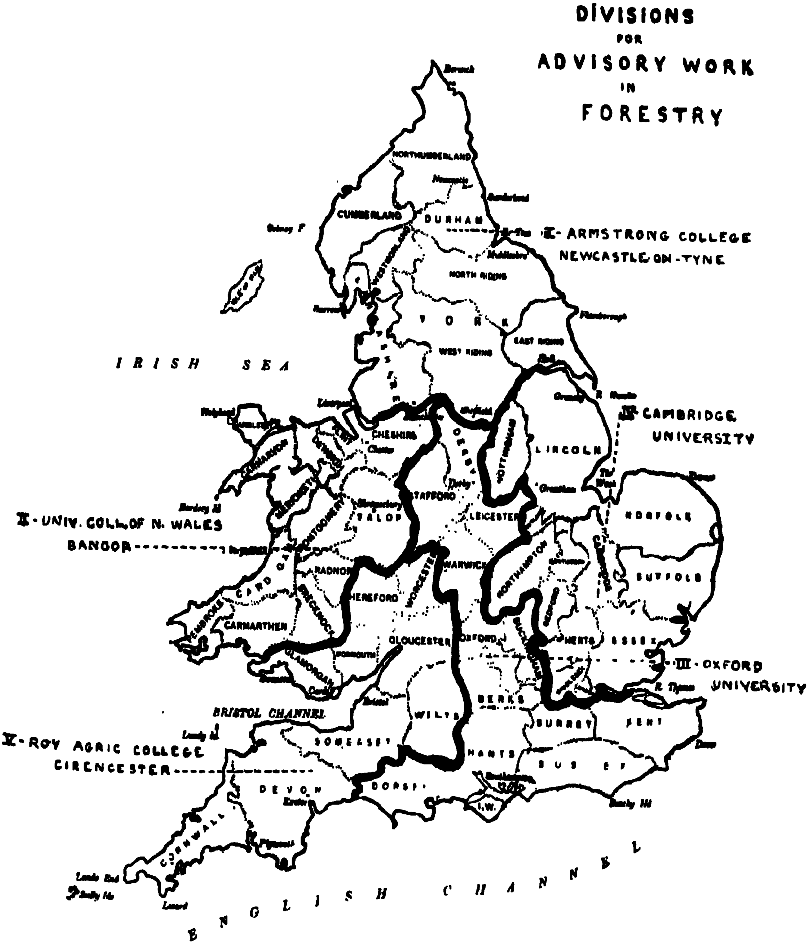
The Districts and advisory officers are as follows:—

I. *Northern District.*—The Counties of Northumberland, Durham, Cumberland, Westmorland, Lancashire and Yorkshire. *Advisory Officer*—Mr. J. F. Annand, the Armstrong College, Newcastle-on-Tyne.

II. *Welsh District.*—The whole of Wales (except Glamorgan), Cheshire, and Shropshire. *Advisory Officer*—Mr. Fraser Story, University College of North Wales, Bangor.

III. *Central and Southern District.*—The Counties of Derby, Stafford, Leicester, Warwick, Oxford, Bucks, Berks, Surrey, Kent, Sussex, Hampshire and Dorset. Mr. S. Carr, School of Forestry, Oxford, has been appointed Advisory Officer, the appointment to take effect from February 1st, 1913. In the meantime the Professor of Forestry, Sir Wm. Schlich, will personally attend to any applications for advice.

IV. *Eastern Districts.*—The Counties of Lincoln, Nottingham, Rutland, Northampton, Huntingdon, Bedford, Cambridge, Norfolk, Suffolk, Essex, Hertford and Middlesex. It is hoped that the Advisory Officer will be appointed early in the present year. In the meantime applications should be addressed to the Reader in Forestry, Mr. A. Henry, School of Forestry, Cambridge.



V. *South-Western District.*—The Counties of Hereford, Worcester, Gloucester, Monmouth, Wilts, Somerset, Devon, and Cornwall; also the county of Glamorgan. *Advisory Officer*—Mr. H. A. Pritchard, Royal Agricultural College, Cirencester.

The distribution of the advisory districts is shown in the outline map (p. 851), and persons desirous of obtaining advice on forestry should address their applications either to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W., or direct to the advisory officer in charge of the district in which their woods are situated.

Destruction of Meadow Saffron.*

An implement specially made with a view to the eradication of Meadow Saffron (*Colchicum autumnale*, L.) is described in the *Illustrierte Landwirtschaftliche Zeitung*, No. 27, 1912.† It consists of a "digging iron" to which pieces of iron are fixed crosswise with the lower edges sharpened for cutting. The implement is driven into the ground over the plant, and the corm of the meadow saffron is cut to pieces, thus causing it to rot.

In an implement mentioned by *Bornemann* (*Die wichtigsten landwirtschaftlichen Unkräuter*, p. 68) as having given good results, a short three-pronged iron moving on a hinge is fixed at the end of a digging iron resembling a crow-bar, with the lower part somewhat flattened. On the tool being driven into the ground the prongs close in an upward direction, allowing easy passage downward, but on turning the implement round in the ground so that the prongs are underneath the corm and pulling up, the prongs automatically open and grasp the corm from below, so that it can then be pulled right out of the ground. Some skill is necessary, however, and, to ensure eradication, the procedure has to be repeated for several years, as the younger plants gradually mature. It is stated to be a sure means of eradication, however, where the meadow is not extensively infested with meadow saffron.

Another method mentioned by the above paper which leads to the gradual extirpation of the weed consists of dragging over the meadow, by horse labour, a cross-beam to which bundles of brushwood and bushes have been fixed, the cross-beam being weighted to the extent desired. This is carried out in autumn when the meadow saffron is beginning to blossom; the flowers being destroyed, the succeeding year's seeding is thus prevented. If the procedure is carried on for several years the weeds will be gradually eradicated.

---

* An article on Meadow Saffron, with a coloured plate, was published in the *Journal* for April, 1908, p. 44, while Leaflet No. 222 deals with the same weed.

† *Prak. Blätter für Pflanzenbau u. Pflanzenschutz*, Oct., 1912, p. 124.

Meadow saffron is a poisonous plant, and care should be taken that stock are not allowed in meadows and pastures where it is growing. Three means of attacking it may be adopted: (1) the use of one of the irons mentioned above; (2) the destruction of the flowers between August and October; and (3) the cutting or hand-pulling of the leaves in spring. It is probable that repeated and thorough destruction of the flowers and leaves will suffice to eradicate the plant in three years, but the use of the iron will make eradication more certain.

Agricultural Labour in the United States.*

The percentage of employed persons engaged in agriculture (excluding forestry and fisheries) in the United States dropped from 83·1 per cent. in 1820 to 77·5 per cent. in 1840, 47·3 per cent. in 1870, 44·1 per cent. in 1880, 37·2 per cent. in 1890, and to 35·3 per cent. in 1900, but the absolute number of persons engaged in agriculture increased from 2,068,958 in 1820 to 10,249,651 in 1900; and the number of agricultural labourers rose from 2,885,996 in 1870 to 4,410,877 in 1900. The extent to which the United States has been dependent on immigration for its agricultural population is shown by the fact that in 1900 765,555 agricultural labourers had foreign parentage. Of these 100,404 were of Irish origin, 67,015 of British origin, and 263,027 of German origin.

There has been a great increase in the use of machinery on farms in the United States, which must, to some extent, have replaced labour. The value of agricultural machinery and implements on farms rose from £85,000,000 in 1880 to £264,000,000 in 1910.

Wages.—Between 1866 and 1909 the rates of wages of agricultural labour have been investigated nineteen times by the Bureau of Statistics.† The results are given in the following table, which shows the average wage rates of outdoor labour of men on farms, with board, between 1866 and 1909 (a dollar has been reckoned at 4*s.* 2*d.*). All values in the table have been expressed in terms of gold currency:—

---

* U.S. Department of Agriculture, Bureau of Statistics, Bull 94, *The Supply of Farm Labour.*

† U.S. Dept. of Agric., Bur. of Statistics, Bull. 99, *Wages of Farm Labour.*

Year.	Per month in hiring by the—			Per day for day labour.	
	Year.	Season.	Year and Season.	Harvest.	Other.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
1866	42 0	52 10	—	4 4	2 8
1869	41 6	52 8	—	4 5	2 7
1875	46 6	56 4	—	4 11	2 10
1878	45 3	—	—	4 4	2 6
1880	48 9	—	—	4 8	2 8
1881	51 4	—	—	4 10	2 9
1882	53 8	—	—	5 0	2 11
1885	54 6	—	—	4 10	2 11
1888	55 4	—	—	4 6	3 0
1890	55 4	—	—	4 6	3 0
1892	—	—	56 2	4 6	3 0
1893	—	—	57 8	4 5	3 0
1894	—	—	52 11	4 0	2 8
1895	—	—	53 1	4 0	2 8
1898	—	—	55 4	4 4	2 11
1899	—	—	57 11	4 7	3 1
1902	—	—	64 7	5 1	3 5
1906	—	—	78 0	6 0	4 3
1909	75 2	86 8	83 4	5 11	4 3

It is pointed out that the above wages do not express the real earnings often received by the farm labourer. Thus, the labourer may receive, in addition to money wages, the use of a dwelling and garden, stabling, feed and pasture for stock, dairy produce and vegetables for his family, and similar allowances.

A point of much importance in considering the variation in wages over a large number of years is the difference in the purchasing power of money during the period as measured by the retail prices of food. An attempt has been made in the following table to estimate the real increase in the wages of farm labourers during the period 1890–1907, and to compare this with the real increase in the wages of working men in the United States during the period (100 is taken as the mean for the period 1890–98, and the index numbers for subsequent years given):—

It will be seen that the value in terms of food of the wages of agricultural labourers has increased considerably in the United States during the last eighteen years, while the value

Year.	United States Bureau of Labour, Index Number.			Wage rate of outdoor labour of men on farms.			Purchasing power measured by retail prices of food.		
	Earnings of working men.	Retail prices of food.	Purchasing power.	Per month, in hiring by the year and season.	Per day for day labour.		Per month, in hiring by the year and season.	Per day for day labour.	
					Harvest.	Other.		Harvest.	Other.
1890-1898	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
1899-1907	111·2	109·7	101·4	121·0	122·5	126·6	110·1	111·5	115·2
1899	101·3	99·4	101·9	103·6	104·7	107·6	104·2	105·3	108·2
1900	104·2	101·0	103·2	107·3	108·5	110·9	106·2	107·4	109·8
1901	106·0	105·1	100·9	111·1	113·2	115·2	105·7	107·7	109·6
1902	109·3	110·8	98·6	114·7	117·1	118·5	103·5	105·7	106·9
1903	112·4	110·2	102·0	120·0	121·7	123·9	108·9	110·4	112·4
1904	112·3	111·6	100·6	125·3	126·4	130·4	112·3	113·3	116·8
1905	114·1	112·3	101·6	130·5	131·8	137·0	116·2	117·4	122·0
1906	118·6	115·6	102·6	135·8	136·4	143·5	117·5	118·0	124·1
1907	122·5	120·5	101·7	141·1	141·1	150·0	117·1	117·1	124·5

of the wages of working men in towns has remained practically stationary.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Manuring of Meadow Hay (*Armstrong Coll. and Westmorland Co. Educ. Comm., Bull.* 9; *Mr. F. P. Walker and Mr. S. H. Collins*).—Experiments have been carried out at three centres in Westmorland since 1907 to ascertain the effect of yearly dressings of farmyard manure and of artificial manures on meadow land. The soils at the three centres varied considerably, and the results at each centre are dealt with separately.

On a sandy loam in good condition phosphates alone have given profitable results, particularly when in the form of superphosphate, but the most satisfactory return has been obtained by the use of basic slag, superphosphate and muriate of potash together. The plot receiving dung at the rate of ten tons per acre annually has given the largest crop, but if the manure is valued at 5*s.* a ton, and the hay at £3 a ton, the system of manuring has not proved economical. Alternate dressings of dung and slag did not produce a profitable crop of hay, but the aftermath on the plots so manured was much more closely eaten by stock than that on the one dressed with dung every year.

---

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

At the second centre, on a gravelly soil deficient in lime, basic slag given alone produced a profitable increase, while superphosphate did not. The heaviest crops of hay were obtained on the two plots annually dressed with farmyard manure and a complete mixture of artificials respectively, but whereas the former on account of the high cost (estimated at 50*s.* per acre) resulted in a net loss, the latter was one of the most profitable plots. As at the first centre a mixture of basic slag, superphosphate and muriate of potash produced a profitable increase and resulted in a high quality aftermath. The need of this light soil for potash was very evident, and the absence of potash from the mixture of manures made itself more felt than the absence of phosphates.

At the third centre, on a light but badly drained soil, the most satisfactory system of manuring appeared to consist of alternate dressings of farmyard manure and basic slag. Artificial manures alone did not give a satisfactory return.

Valuation of Hay.—Full chemical analyses of the hay from the plots at one centre were made and each sample was valued in accordance with the following system: allow 3*s.* for each per cent. of albuminoids, 1*s.* for each per cent. of carbohydrates, and deduct 6*d.* for each per cent. of fibre.

Peat Moss Litter Manure (*Biedermann's Zentralblatt für Agrikulturchemie, November,* 1912).—Reference is made to the article in this *Journal* for December, 1911, p. 756, on peat moss litter manure, in which a report of Dr. Voelcker ascribed the ill-effects of this manure to its acidity and to the consequent unhealthy, imperfectly oxidised condition of the soil (iron compounds being present in the soil in the ferrous condition).

This publication refers to the good results obtained with this manure in other countries, and claims that the acidity of peat moss litter manure is not too large to be neutralised by the bases of a normal soil without causing the reduction of Fe_2O_3 compounds into FeO compounds. Laboratory experiments carried out at Jonköping with two samples of peat moss litter of marked acidity, mixed with various manures and examined when fresh, and when four weeks, six weeks, and three months old, showed in each case that the acidity of the peat moss litter was neutralised by the ammonia of the manure.

At the experimental grounds at Flahult and Torestorp peat moss litter manure on both ordinary and moor soils has given good results with garden crops both as a top dressing and when mixed with the soil. The manure is also much used by Swedish commercial gardeners for all crops. The advantages claimed are that it is the best material for absorbing excreta, and for minimising the unavoidable loss of nitrogen in stable manure; that it has a deodorising and hence disinfecting effect on the manure; and that the manure made from it is more efficacious than when other materials are used as litter.

FEEDING STUFFS.

Composition and Digestibility of the Ether Extracts of Hays and Fodders (*Texas Agric. Exp. Sta., Bull.* 150).—Previous experiments have indicated that the ether extracts of hays and fodders may contain quantities of substances other than fat. The investigations described in this Bulletin showed that, in the eighteen fodders examined, the amount of unsaponifiable matter present in the extract varied from 36 per cent. to 72 per cent., with an average of 58 per cent., and consisted largely of wax alcohols. The digestibility of the unsaponifiable matter varied from 0 to 86·6 per cent., with an average of 29·1 per cent.; that of the saponifiable matter varied from 8·6 per cent. to 92·3 per cent., with an average of 66·4 per cent. It is emphasised that it is not correct to use the term "fats or oils" to designate the ether extract of hays and fodders.

DAIRYING.

The Iron Content of Milk (*Biedermann's Zentralblatt für Agrikulturchemie, November*, 1912).—The divergencies in the results obtained by various experimenters as to the amount of iron in milk (viz., from 1 mg. to 15 mg. per litre) are ascribed in this publication to differences in the methods of collection and subsequent treatment of the milk. In these experiments the smallest content of iron was found when the cows were milked into glass vessels and the highest in the marketed milk, the latter milk having stood in iron vessels. The iron content of the former milk varied between 0·4 and 0·7 mg. per litre and averaged 0·5 mg. per litre. Human milk contains from one and a half times to twice as much iron as cow's milk.

Influence of Fatness of Cow at Parturition on the Percentage of Fat in the Milk (*Univ. of Missouri Agric. Exp. Sta., Bull.* 100).—An examination of the records of official tests with Holstein Friesian cows showed that the fat content of the milk for a short time at the beginning of a lactation period may have little relation to the real average fat content of the milk produced by any particular animal. Investigations with cows of various breeds and in different conditions were carried out, and it is concluded that, provided the cow is underfed after calving, the percentage of fat in the milk for the first twenty or thirty days of the lactation period is influenced to a considerable extent by the fatness of the cow at calving. In some cases this influence appeared to extend to a certain degree for at least three months.

FORESTRY.

Forty Years' Management of Woods (*Quart. Jour. For., Oct.*, 1912).—Reliable data as to the pecuniary returns from woods over a period of forty years are supplied in this publication by Mr. D. Tait. The woods in question are on the Owston Park Estate, near Doncaster, and the management has been carried on by Mr. Tait since 1869. At that date there were 350 acres of enclosed plantations, four-fifths of the woods being at an elevation of 19 to 35 ft. above sea-level, on a clay soil, or in some cases on a peaty soil resting on clay. The woods above 35 ft. are on the Magnesian Limestone formation on a good free soil. Since 1869 12 acres have been grubbed out and converted into arable land, and 57 acres have been planted. In 1912 there were 380 acres of enclosed woods.

In 1869 the ages of the woods were from thirty to ninety years. In 60 acres of the younger woods there was a fair sprinkling of larch, the principal crop being oak, with a small proportion of ash. In the remaining portion there was a fair sprinkling of spruce throughout, but the main crop was oak. On the peaty soil ash was the main crop, but there was also some Scotch fir. In the higher woods there was more of a mixture of hard wood trees, comprising beech, elm, sycamore, oak, ash, and various other kinds. On the low land there was also a proportion of alder, birch, poplar, willow, &c.

The gross quantity of timber felled for sale during forty consecutive annual thinnings was 328,743 ft., the average per year being just over 8,200 ft., the average sum received per year being £370. The whole of the woods at the present time are well stocked with trees of various sizes, and, taken as a whole, they contain as large a quantity of saleable timber as they did forty years ago.

The average annual cost of labour for keeping up the plantations was £145, or 8*s*. per acre. This includes the cost of felling timber, and all manual labour such as fencing, ditching, &c., as well as labour in replanting, but does not include the making of plantations on land not formerly planted. The day wages for the men were 3*s*. 4*d*. The price for felling plantation grown timber was 2*s*. 3*d*. per ton of 40 ft. Horse labour was a considerable item, and averaged £19 5*s*. per year, being £17 5*s*. for dragging timber to the margin of the woods for sale and £2 for carting fencing, &c.

Increasing the Durability of Fence Posts (*Maryland Agric. Expt. Sta., Bull.* 163).—Fence posts were treated with preservatives in various ways in 1888 and examined after twenty years. It is concluded from experiments with posts of cedar and chestnut wood that applying a preservative with a brush is not very effective; that creosote is more efficient than either coal tar or crude petroleum; that filling in stones round the post does not increase its durability. Charring the part of the post to be placed underground was found beneficial only in the case of green posts, charring, it is stated, acting by hastening seasoning and possibly sterilising the wood.

Experiments were commenced at the station in 1909 in co-operation with the United States Forest Service. Details of the various methods of treatment were given in this *Journal* for January, 1912, p. 850. None of the posts treated with creosote, tar, or crude petroleum show any perceptible decay after two years' use; while a large number of the untreated posts of the same kind of wood, and of the same size and shape as those that were treated, have decayed to such an extent as to make them unserviceable after two years' use. The relative durability of the untreated woods so far is as follows (the most durable are placed first): locust, chestnut, spruce, beech, maple, pin oak, birch, sweet gum, white poplar, willow, yellow poplar, black gum, and sycamore.

WEEDS AND PLANT PESTS.

Effect of Lime on Sorrel ("Sour-dock") in Meadows (*Yorks. Co. for Agric. Educ. and Univ. of Leeds, Guide to Expts.*, 1912).—A number of plots were laid down in 1900 to compare the effects of lime applied in various ways and at different seasons to meadow land. The results with regard to the effect on weight of hay are inconclusive, but the action of lime on sorrel has been clearly shown. This weed was at first prevalent on all the plots, and it is still prominent in the herbage of the unlimed plots; on the limed plots it has been checked to a very great extent.

The Effects of Road-Tarring (*Bull. Bur. Agric. Int. and Plant Diseases, June,* 1912, *and U.S. Daily Cons. Trade Repts., No.* 103).—A writer in the *Annales des Sciences Naturelles,* discussing the tarring of roads and its effects on the neighbouring vegetation, comes to the conclusion that the use of gas-tar on town roads which are much exposed to the sun, and where the traffic is heavy, is very detrimental to the growth of herbaceous or soft plants along the sides. The fine dust raised, falling upon the leaves of the plants, stunts their growth, although less damage is done to plants which possess a thick cuticle (*e.g.*, ivy), and have therefore greater powers of resistance. The refined tar used in England is less injurious than the raw product. The effects of the tar may not be seen for several years.

A report made to the French Academy of Science draws attention to the danger to the eyes from dust arising from tarred roads. Experiments with such dust were made upon the eyes of rabbits, and showed that, while pure road dust had scarcely any effect on the eyes, the latter were greatly affected by the presence of tar, and serious diseases broke out after its application.

POULTRY.

Digestion Experiments with Poultry (*Maine Agric. Expt. Sta., Bull. No.* 184).—The fact that the digestibility of feeding-stuffs in the case of ruminants, horses and pigs, had received considerable attention, but that few experiments had been made with poultry, suggested the investigations described in this bulletin.

The difficulty of carrying out experiments of this nature was considerable owing to the fact that the urine and the solid dung of fowls are excreted together.

Experiments were first undertaken with year-old hens, chiefly with a view to gaining experience as to the best methods to be adopted, and the result of the work done with these birds was not very satisfactory, as they were nervous and lost condition; cockerels proved the most satisfactory subjects for experiment.

Two rooms were set apart for the birds; in one they were kept during the resting period; in the other, cages were provided for their reception. Precautions were taken to arrange for the provision of feeding and drinking dishes which would prevent the food being spilled. The duration of the experiments was 12–14 days, divided into two periods, a preliminary period of 5 to 7 days, when the amount the bird would eat was determined and the alimentary canal freed from other food, and a collection period when the feces were collected. As it was impossible to tell how much water the birds actually swallowed, no record was kept of the weight of water consumed.

The birds were fed at regular hours and the fæces collected at the same time; at the end of the collection period the fæces were taken to the laboratory, air-dried, and submitted to analysis.

The results obtained from these experiments indicated that the digestion coefficients of most foods for poultry are not materially different from those which obtain in the case of other farm animals, save that, unlike ruminants, poultry digest very little crude fibre.

Maize gave a higher digestibility than any other grain tested. Wheat-bran gave a low digestibility. A mixture of equal parts of maize meal and finely cut early clover was sufficiently bulky to feed with concentrated food, and was more digestible than bran. The results confirm those of other investigators in showing that maize is a most valuable grain for poultry. It cannot be given alone, as it is too concentrated a food, and is deficient in protein, but in combination with foods rich in protein and some bulky material such as cut clover it makes a most desirable ration.

Poultry Experiments (*South Australia, Report of the Poultry Expert for the year* 1910–11).—The report deals with the general progress of the poultry industry in South Australia during the year ended June 30th, 1911.

Attention is drawn to the increasing tendency of White Leghorns to become broody. Of 61 pens of Leghorns and Minorcas entered in a laying competition only nine pens finished the year without any cases of broodiness.

The result of experiments dealing with the weight of eggs produced by three White Leghorns and three Black Orpingtons during a year is recorded, and the results tend to show that the limits of variation in the weight of different eggs laid by the same hen are considerable; in nearly every instance, after a rest of a day or two, the succeeding egg showed an increase of weight.

Egg-laying Competitions (*Dept. of Agric., New South Wales, Farmers' Bulletin No.* 57).—On April 1st, 1912, ten years' work in connection with the egg-laying competitions conducted at the Hawkesbury Agricultural College was completed. The following table sets out the results of these tests during the ten-year period:—

Year.	No. of Pens.	Winning Total.	Lowest Total.	Average per pen.	Average Price of Eggs.		Average Value per Hen.		Feed per Hen.		Profit over Feed.	
					s.	d.	s.	d.	s.	d.	s.	d.
1st	38	1,113	459	130	1	1	15	6	6	0	9	6
2nd	70	1,308	666	163	1	3¾	17	9	5	9¾	12	0
3rd	100	1,224	532	152	1	0	12	9	4	5½	8	3
4th	100	1,411	635	166	0	11½	13	3	5	3½	8	0
5th	100	1,481	721	171	1	0½	14	10	5	10	9	0
6th	60	1,474	665	173	1	2¼	17	2	7	0	10	2
7th	50	1,379	656	180	1	3¼	19	2	7	9½	11	4
8th	60	1,394	739	181	1	6½	21	9	6	9	15	0
9th	40	1,321	658	168	1	2	16	3½	6	1½	10	2
10th	50	1,389	687	184	1	2½	18	5½	6	1½	12	4

The value of feeding laying hens with animal food in conjunction with their ordinary rations was tested in connection with the tenth competition. Ten pens of pullets (six birds per pen) were fed without animal food, and the results contrasted with the yield of ten pens of pullets of similar age, strain, and breed, entered by the same owners. These latter ten pens were fed with meat in the form of boiled bullocks' livers and the soup therefrom at the rate of about 2 lb. of liver per week

to each pen. The average results showed that the addition of meat to the diet is of some advantage in inducing the production of eggs, but this only amounted to an increase of six eggs per hen for the year, and an additional gain of 6*d*. per hen for the extra eggs produced.

NO MEAT V. MEAT FEEDING TEST.

	No. Meat.	Meat Fed.
Total eggs laid	11,112	11,646
Average per hen...	185·2	191·0
Market value per hen	18*s*. 10*d*.	19*s*. 4*d*.
Cost of feed per hen	5*s*. 10*d*.	6*s*. 1½*d*.
Profit over feed per hen	13*s*. 0*d*.	13*s*. 2½*a*.

In connection with this test it was noteworthy that while none of the White Leghorns receiving no meat exhibited signs of broodiness, there were five out of the thirty birds receiving meat which became broody.

MISCELLANEOUS.

Growth of Fruit and Vegetables (*Worcestershire C.C. Educ. Com., Annual Rept. on County Experimental Garden, Droitwich,* 1911).—Observations were made of the yield of a large number of different varieties of fruit and vegetables under various systems of treatment, and experiments to determine the effect of pruning, manuring, &c., have been laid out.

Feeding Sour Milk to Calves as a Remedy for Scouring (*Bull. Bur. Agric. Int. and Pl. Dis., August,* 1912).—Good results have been obtained in experiments in Germany, in which the sour milk known as Yoghürt, *i.e.*, milk to which cultures of *B. bulgaricus* have been added, has been fed to calves as a preventive against scouring. The bacteria in the milk are stated to act (1) by producing in the intestines of the animal a great quantity of lactic acid, which acts as a disinfectant, and prevents the development of pathogenic bacteria; at the same time the activity of the intestine is stimulated; (2) by hindering the multiplication of other bacteria by means of the development of the Yoghürt bacteria; (3) probably by producing a ferment which destroys the bacilli causing scour in calves.

Feeding the sour milk to calves from the first to the fifth day of their life seemed to be sufficient to prevent scour.

NOTES ON AGRICULTURAL CO-OPERATION.

Agricultural Co-operative Credit Societies in England and Wales in 1911.

In this *Journal* for December, 1911, an account was given of the Co-operative Credit Societies formed among small agriculturists in England and Wales, and of the principles on which they work. Statistics are now available for the year ending 31st December, 1911. During that year two societies ceased to exist and seven new societies were registered, so that the total number of societies on the Register at the end of the year was forty-five, as compared with forty at the beginning of the year.

No report has been received from three societies, and the following statistics relate to the remaining forty-two, which have sent in annual returns. They had altogether 765 members, giving an average of eighteen members per society, the largest society, that at Spalding, having a membership of seventy-six. Their main object is to grant loans to their members for productive agricultural purposes, and the number and amount of loans granted during the year is one of the best criteria of the utility of a society. Of the forty-two societies, twenty-one granted no loans during the year; the remaining twenty-one granted one hundred and ten loans, amounting to £1,399, which gives an average per society of five loans granted, and of nearly £13 per loan (in the previous year the number of loans granted was 119 and the total amount lent was £1,390). These twenty-one societies had a total membership of 504, so that on the average one in five of the members received a loan during the year; but in the Castle Morton, Hedge End, High Wycombe, and Halstead societies about half the members were granted loans, and in the small Well Hill society nine out of eleven members received loans during the year.

For all the forty-two societies reporting, the total cash receipts of the year amounted to £1,880, made up of the following items: £1,294 repaid by members who had borrowed from their societies, £79 received as interest, £203 received as deposits, £293 borrowed from other sources, and miscellaneous receipts amounting to £11. The cash payments totalled £1,816, which included £1,399 advanced to members, deposits repaid £110, other borrowings repaid £224, interest paid £49, expenses of management actually paid £27, and other payments £7. The opening cash balance was £376 and the closing cash balance £440.

According to the combined profit and loss accounts the total earnings of these forty-two societies during the year amounted to £106, of which £92 represented interest earned within the year, and the charges of the year amounted to £92, of which £59 represented interest incurred and £33 expenses of management. Thus the net profit for the year for all the societies taken together was £14, but twelve societies showed a small loss on the working of the year and nineteen showed a profit amounting in all to £22, the largest profit being £4 18*s*. at Scawby, the oldest society. One society wrote off a bad debt amounting to £7, due to the defalcation of its treasurer, so that the net balance of profit from the commencement of the societies is shown as having increased during the year from £265 to £272. The committee of the society referred to are, however, making good the deficit out of their own pockets, so that the society itself will ultimately suffer no loss.

The combined balance sheet of these forty-two societies shows that they had at the end of the year liabilities amounting to £1,757, which included £1,081 due on deposits with the societies, £22 due for interest accrued, and £640 due to banks. Their assets were £2,029, including £1,447 out on loan to members, £26 due for accrued interest, and £550 cash and investments. Thus the surplus of assets over liabilities amounted to £272, there being a deficit of £18 in the funds of eight societies and a surplus of £290 in the funds of twenty-five societies. This surplus represents the savings of past years, which under the rules are to be held as a reserve fund to meet exceptional losses; the largest surplus is at Wiggenhall, where it amounts to £79, and three other societies have accumulated reserves amounting to over £40 in each case. The reserve funds of the different societies are their own property, on which they pay no interest, and together they now amount to nearly one-fifth of the total sum required by members as loans during the year.

The working expenses of these societies are small, as almost all the work is done gratuitously. For the whole year they amounted to only £33, or less than £1 per society, and a little over 2 per cent. on the amount lent during the year. They are met partly from the interest on the reserve fund and partly from the margin between the interest received by the society on loans to its members and the interest paid by the society on money borrowed by it. The rates most commonly charged by societies on loans to members are 5 and 6 per cent., but one society, that at Hedge End, having accumulated a good reserve fund, now manages to make advances to its members at the low rate of 4 per cent. per annum. A number of societies have been able to secure deposits at 3 per cent., but several of them pay 4 per cent. on deposits, and in some cases higher rates are paid on loans received from banks or other sources. It would seem advisable for a new society to begin by charging 6¼ per cent. on loans to its members and offering 3¾ per cent. interest on deposits, and to endeavour to keep its working expenses well within the margin of 2½ per cent. on the turnover, so as gradually to build up a reserve fund. The experience of the Scawby and other societies shows that when a reserve fund has been accumulated, the society will be able to reduce the rate of interest on loans to its members to 5 per cent., and it may in time hope to follow the example of the Hedge End society and make loans to its members at 4 per cent. Detailed accounts of the Scawby and Hedge End societies will be found in this *Journal* for January and April, 1912.

Considerable progress has recently been made in securing the assistance of those joint stock banks which have offices in the rural districts, for the provision of credit to small holders and allotment holders through the means of co-operative credit societies. A number of the leading banks have agreed to allow their local managers to give advice to such societies in matters of account and audit, and to give favourable consideration to applications from such societies for

AGRICULTURAL CO-OPERATIVE CREDIT SOCIETIES

Serial Number.	Name of Society.	County.	Year of Registration.	Number of Members.		Loans granted during the Year.	
				At beginning of year.	At end of year.	Number.	Amount.
							£
1	Scawby	Lincoln	1895	32	32	4	125
2	Laxfield	Suffolk	1895	6	6	—	—
3	Grandborough	Warwick	1895	—	—	—	—
4	Castle Morton	Worcester	1896	21	20	11	76
5	Hedge End	Hampshire	1896	34	35	15	161
6	Wiggenhall	Norfolk	1896	45	44	6	89
7	Friskney	Lincoln	1904	32	33	6	89
8	Spalding	Lincoln	1904	76	76	—	—
9	Far Forest	Worcester	1904	7	7	—	—
10	Clophill	Bedford	1905	—	—	—	—
11	Whissonsett	Norfolk	1905	24	26	6	71
12	Barley	Hertford	1907	13	13	—	—
13	Brookvale	Leicester	1907	42	43	4	25
14	Dormansland	Surrey	1908	22	18	—	—
15	High Wycombe	Bucks	1908	13	13	7	74
16	Mountsorrel	Leicester	1908	27	29	1	35
17	Bromley	Kent	1908	18	18	—	—
18	Froomeshill	Hereford	1908	12	11	—	—
19	Coates	Cambridge	1908	9	9	—	—
20	"All for Each," Southall	Middlesex	1908	9	10	—	—
21	Coggeshall	Essex	1909	20	22	5	110
22	Tiptree	Essex	1909	26	22	5	94
23	St. Fagans	Glamorgan	1909	13	13	—	—
24	Limpsfield	Surrey	1909	21	20	2	13
25	Croydon	Surrey	1909	23	41	1	3
26	Trunch	Norfolk	1909	8	8	—	—
27	Cadoxton	Glamorgan	1909	9	9	—	—
28	Drayton-Parslow	Bucks	1909	22	22	7	54
29	Oadby	Leicester	1910	19	19	4	25
30	Wayford	Norfolk	1910	8	8	—	—
31	Halstead	Kent	1910	14	15	9	98
32	Barry	Glamorgan	1910	—	—	—	—
33	High Halstow	Kent	1910	9	9	—	—
34	Islip	Oxford	1910	14	17	3	30
35	Epsom	Surrey	1910	—	—	—	—
36	Cradley	Worcester	1910	9	11	1	3
37	Heyford	Oxford	1910	—	—	—	—
38	Mansfield Woodhouse	Notts	1910	—	9	—	—
39	Milton	Cambridge	1911	—	7	—	—
40	Moulton	Northants	1911	—	11	—	—
41	Well Hill	Kent	1911	—	11	9	205
42	Chobham	Surrey	1911	—	13	2	16
43	Ashford	Middlesex	1911	—	16	2	3
44	Ardwick-le-Street	York	1911	—	6	—	—
45	Pinvin	Worcester	1911	—	13	—	—
	Total for 42 Societies reporting			657	765	110	1399

IN ENGLAND AND WALES. STATISTICS FOR 1911.

Loans Repaid during the Year. Amount.	Rate of Interest Received by the Society.		Rate of Interest Paid by the Society.		Deposits Received during the Year.	Deposits Repaid during the Year.	Serial Number.
	On Loans to Members.	On other Investments.	On Deposits.	On other Borrowings.			
£ s.	%	%	%	%	£ s.	£ s.	
125 0	5	3‡	3	5*	—	5 0	1
25 0	5	2½	3	—	11 0	25 0	2
—	—	—	—	—	—	—	3
34 5	6	2½†	3	4‡	—	—	4
150 0	4	2½†	3	—	—	—	5
107 0	5	3	4	3*	0 10	2 4	6
26 0	5	2½†	3	4 & 5‡	80 0	10 0	7
3 0	5	5	4	—	1 0	5 0	8
—	6	2½†	4	3	—	—	9
—	—	—	—	—	—	—	10
51 10	5	2½*	3	—	25 18	13 2	11
—	6	—	—	4‡	—	—	12
43 10	5	3*	3	4 & 5‡	9 12	9 3	13
—	—	—	—	—	—	—	14
72 15	6	—	—	4½‡	—	—	15
78 0	5	—	2½	—	—	—	16
4 0	—	—	—	—	—	0 10	17
—	—	—	—	—	—	—	18
—	—	—	—	—	—	—	19
—	6	—	3		1 10	—	20
78 10	5	—	—	—	27 0	27 0	21
173 13	5	—	—	4*	—	—	22
—	—	—	—	—	—	—	23
8 0	5	2½†	—	—	—	—	24
3 0	5	2½	3	—	15 19	6 3	25
—	—	—	—	—	—	—	26
—	—	—	—	—	—	0 1	27
111 10	6	0	3	5‡	—	—	28
25 0	—	—	—	—	4 10	4 1	29
—	—	—	—	—	—	—	30
73 0	5	—	—	4*	—	—	31
—	—	—	—	—	—	—	32
—	—	—	—	—	—	—	33
5 0	6	—	—	—	—	—	34
—	—	—	—	—	—	—	35
6 0	—	—	—	—	0 12	3 5	36
—	—	—	—	—	—	—	37
—	—	—	—	—	1 18	—	38
—	—	—	—	—	—	—	39
—	—	—	—	—	—	—	40
83 0	—	—	—	—	—	—	41
4 0	—	—	—	—	11 14	—	42
3 10	—	—	—	—	12 1	—	43
—	—	—	—	—	0 2	—	44
—	—	—	—	—	—	—	45
1294 3	—	—	—	—	203 6	110 9	—

* Joint Stock Bank. † Savings Bank. ‡ Central Bank.

AGRICULTURAL CO-OPERATIVE CREDIT

STATISTICS FOR

Serial Number.	Name of Society.	Interest earned within the Year.	Interest charge incurred within the Year.	Expenses of Management.	Result of the Year's working.		Loans due from Members at the End of the Year.
					Profit.	Loss.	
		£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
1	Scawby	10 2	5 13	0 10	4 18	—	150 0
2	Laxfield	1 13	0 18	0 5	0 11	—	15 0
3	Grandborough	—	—	—	—	—	—
4	Castle Morton	2 13	2 18	1 14	—	0 17	48 5
5	Hedge End...	7 1	4 14	1 4	1 8	—	183 14
6	Wiggenhall...	5 8	1 0	3 12	0 18	—	89 0
7	Friskney	9 3	6 4	1 10	1 9	—	196 0
8	Spalding	7 13	5 18	1 10	0 5	—	—
9	Far Forest	—	—	0 1	—	0 1	0 3
10	Clophill	—	—	—	—	—	—
11	Whissonsett	3 9	2 2	1 2	1 11	—	91 0
12	Barley	—	—	—	—	—	—
13	Brookvale	8 13	7 8	2 5	—	0 19	129 19
14	Dormansland	—	—	—	—	—	—
15	High Wycombe	4 4	3 3	1 18	—	0 17	72 0
16	Mountsorrel	7 2	4 2	0 18	2 4	—	57 15
17	Bromley	0 16	1 2	0 13	—	0 19	9 0
18	Froomeshill...	—	—	0 12	0 1	—	—
19	Coates	—	—	—	—	—	—
20	All for Each, Southall	—	—	—	—	—	—
21	Coggeshall	4 12	—	0 12	4 8	—	51 10
22	Tiptree...	4 6	1 18	2 16	—	0 7	20 0
23	St. Fagans	—	—	0 6	—	0 6	—
24	Limpsfield	0 8	—	0 3	0 4	—	10 0
25	Croydon	0 3	—	0 4	—	4 7	—
26	Trunch...	—	—	—	—	—	—
27	Cadoxton	—	—	0 2	—	0 2	—
28	Drayton Parslow ...	5 5	4 13	0 6	0 12	—	44 10
29	Oadby	2 13	2 2	0 7	0 4	—	50 0
30	Wayford	—	—	—	—	—	—
31	Halstead	3 3	2 6	0 3	0 16	—	65 0
32	Barry	—	—	—	—	—	—
33	High Halstow	—	—	—	—	—	—
34	Islip	0 6	0 4	0 7	0 1	—	30 0
35	Epsom	—	—	—	—	—	—
36	Cradley	0 2	—	—	0 5	—	—
37	Heyford	—	—	—	—	—	—
38	Mansfield Woodhouse .	—	—	0 15	—	0 1	—
39	Milton	—	—	—	1 7	—	—
40	Moulton	—	—	—	0 10	—	—
41	Well Hill	3 4	2 17	1 13	0 2	—	122 0
42	Chobham	0 4	0 3	0 15	—	4 9	12 0
43	Ashford	0 1	—	4 17	—	1 3	—
44	Ardwick-le-Street ...	—	—	1 16	—	—	—
45	Pinvin	—	—	—	—	—	—
Total for 42 Societies reporting		92 4	59 5	32 16	21 14	7 6	1446 16

SOCIETIES IN ENGLAND AND WALES.

1911 (*continued*).

Cash in Hand and at Bank at the End of the Year.	Total Assets.	Due to Depositors at the End of the Year.	Due to Banks at the End of the Year.	Total Liabilities.	Gross Profit or Loss to date (including Reserve Fund).		Serial Number.
					Profit.	Loss.	
£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s	
103 11	261 6	181 0	—	191 12	69 14	—	1
13 10	28 10	15 0	—	15 0	13 10	—	2
—	—	—	—	—	—	—	3
7 5	55 12	7 10	44 0	51 10	4 2	—	4
12 1	197 4	156 0	—	156 0	41 4	—	5
10 12	101 16	22 3	—	22 16	79 0	—	6
9 7	205 7	197 0	—	197 0	8 7	—	7
150 0	150 0	146 12	2 16	149 8	0 12	—	8
0 10	0 18	—	—	—	0 18	—	9
—	—	—	—	—	—	—	10
48 6	139 7	84 15	50 0	134 15	4 11	—	11
2 18	2 18	2 10	—	2 10	0 8	—	12
9 1	149 10	1 5	138 10	147 8	2 3	—	13
0 7	0 7	0 15	—	0 15	—	0 8	14
—	73 7	—	70 0	74 17	—	1 10	15
23 0	80 15	77 0	—	77 0	3 15	—	16
7 12	17 5	4 0	15 0	19 12	—	2 7	17
0 5	0 8	0 10	—	0 10	—	0 3	18
1 18	1 18	1 13	—	1 13	0 5	—	19
—	—	—	—	—	—	—	20
52 19	106 4	100 0	—	100 5	5 19	—	21
26 5	48 12	—	—	—	48 12	—	22
5 16	5 16	4 19	—	4 19	0 17	—	23
0 3	10 3	10 0	—	10 0	0 3	—	24
3 6	3 6	9 16	—	11 0	—	7 14	25
—	—	—	—	—	—	—	26
2 5	2 5	2 5	—	2 5	—	—	27
36 6	81 10	25 0	50 0	79 13	1 18	—	28
2 10	52 10	2 9	50 0	52 9	0 1	—	29
—	—	—	—	—	—	—	30
0 18	65 18	—	65 0	65 0	0 18	—	31
—	—	—	—	—	—	—	32
—	—	—	—	—	—	—	33
3 0	33 0	2 10	30 0	32 10	0 10	—	34
—	—	—	—	—	—	—	35
0 19	0 19	0 8	—	0 8	0 11	—	36
—	—	—	—	—	—	—	37
—	1 16	1 18	—	1 18	—	0 1	38
1 16	—	—	—	—	—	—	39
—	1 8	—	—	—	1 7	—	40
1 8	125 8	—	124 12	124 18	0 10	—	41
—	12 0	11 14	—	11 18	0 2	—	42
12 1	12 1	12 1	—	16 10	—	4 9	43
0 4	0 4	0 3	—	1 7	—	1 3	44
—	—	—	—	—	—	—	45
549 19	2029 8	1080 16	639 18	1757 6	289 17	17 15	

advances at a moderate rate of interest, when the bank is satisfied that the security for the loan is adequate.

The progress made by the co-operative credit movement in England and Wales is slow in comparison with the success attained in several other countries, but even here instances are not wanting of the usefulness of these societies in providing loans of small sums at a low rate of interest to small agriculturists, who could not otherwise have obtained the capital required for their agricultural operations.

Agricultural Co-operation in Belgium in 1910.

A report of the Belgian Ministry of Agriculture on agricultural co-operation in Belgium in 1910 (*Bull. de l'Agriculture et de l'Horticulture*, No. 1, 1912) considers agricultural societies under five heads, viz. :—(1) Miscellaneous societies; (2) societies for the sale of seeds, manures, feeding-stuffs, and agricultural machinery; (3) societies for the sale and manufacture of dairy produce; (4) agricultural credit societies; (5) agricultural insurance societies.

Miscellaneous Agricultural Societies.—These include agricultural committees, agricultural leagues, "farmers' circles," animal and poultry breeding societies, apicultural societies, and horticultural societies.

The aim of the agricultural committees is to develop agriculture by holding shows and competitions, and by maintaining experimental fields. In 1910 there were 161 committees at work, comprising 40,381 members; the sum of £6,700 was spent on competitions.

There were 1,150 agricultural leagues, or associations of farmers for the protection of agricultural interests, in 1910, with 74,049 members.

The "farmers' circles," of which there were 74 in 1910, with 6,929 members, were formed for the promotion of knowledge, principally with regard to domestic economy among farmers' wives.

There were 196 apicultural societies in 1910, with 5,296 members. The principal object of these societies seems to be to hold apicultural conferences.

Societies for the Sale of Seeds, Feeding-stuffs, &c.—There were in 1910 1,237 societies for the sale of seeds, feeding-stuffs, &c., with 73,951 members. The sales of seeds in 1910 amounted to £13,410, of manures to £252,370, of feeding-stuffs to £442,440, and of machinery to £9,160.

Societies for the Sale of Milk, &c.—There were 658 co-operative dairies in 1910, as compared with 626 in 1909. Each member had on the average three cows. The value of the produce sold in 1910 amounted to £1,592,000, *i.e.*, on an average £2,860 per society, and £28 per member. Practically all the produce sold is butter, milk and cheese being comparatively unimportant.

Agricultural Credit Societies.—The agricultural credit institutions are of two types. The first of these, *comptoirs agricoles*, were founded under a law of April 15th, 1884. There were 15 of these at work in 1910, and they made 786 loans of the value of £117,000; 129 of these were less than £40, 627 were between £40 and £400, while 30 were for still larger sums. At the end of 1910, 4,080 loans were outstanding, of the value of £551,000.

The institutions of the second type are the Raiffeisen credit banks, founded under a law of May 18th, 1873; 538 Raiffeisen banks furnished returns in 1910, showing a membership of 27,334, of whom 21,892 were farmers. The number of loans in 1910 was 4,043, to the value of £162,000, while the deposits amounted to £400,000; 1,246 of the loans were less than £10; 997 were between £10 and £20; 778 were between £20 and £40; and 1,022 were above £40.

Agricultural Insurance Societies.—A fund has existed in Western Flanders since 1837 for the compulsory insurance of live stock, compensation being granted for all losses resulting from slaughter of animals ordered by the authorities, and for meat rejected as unsuitable for consumption. There are also co-operative societies for the insurance of livestock against losses other than those covered by compulsory insurance, and for supplementing the compensation granted from the compulsory insurance fund. The compulsory insurance of cattle was established in the province of Antwerp in 1892, but in 1896 the compulsory character was abolished. In this province, as well as in all other provinces, animal insurance is carried on by co-operative societies, which as a rule pay about two-thirds of the value of animals that die.

Compensation for the death of an animal is paid in one of three ways:—

(1) The sum due to the owner of the animal that dies is paid from an insurance fund formed by periodical payments of members.

(2) Only losses of animals entailing seizure of the meat are met from the insurance fund; when the meat is fit for consumption its value is paid by the members in proportion to the number of animals insured by each.

(3) In the third case the society has no insurance fund. On the death of an animal, the meat fit for food is bought by the members at a price agreed on. Where the meat is unfit for consumption the members pay the owner of the animal the amount which they would have paid had the meat been declared fit for food.

In 1910 there were 1,220 societies for the insurance of cattle, and 304,641 animals were insured of the value of £4,500,000. There were 8,721 deaths of animals in 1910, and compensation was granted by the Government in respect of 1,265 of these, so that the total amount paid by the societies on animals (deducting the compensation paid by the Government, and the value of the meat) was £55,300. The expenses of management were £1,930. There were also 230 societies for the insurance of agricultural horses, 7 for the insurance of stallions, 462 for goats, and 112 for pigs.

OFFICIAL NOTICES AND CIRCULARS.

Foot-and-Mouth Disease.

No outbreak of foot-and-mouth disease has been confirmed in Great Britain since that referred to in the article in last month's *Journal* as having been confirmed on the 1st ult., at Kennington, near Ashford, Kent. The restrictions on the movement of animals which were imposed by the Board in connection with that outbreak have been revoked, except those applying to the infected place.

The restrictions which were imposed by the Board on the landing in Great Britain of cattle, sheep, goats, or swine from Ireland, on account of foot-and-mouth disease in that country, have been further modified so as to admit of the landing of store cattle intended for removal, after quarantine at the authorised landing places, to the interior of Great Britain, and also of swine intended for removal to bacon factories or slaughter-houses.

Eighty-three outbreaks of foot-and-mouth disease have in all been confirmed in Great Britain during 1912.

Reproduction of Ordnance Maps.

The Board of Agriculture and Fisheries desire to draw attention to the following rules governing the reproduction or utilisation of Ordnance maps by map-making firms and others:—

(1) Map-making firms will be allowed to use Ordnance maps on all scales as *material* for producing their own maps on scales smaller than 1 inch to 1 mile, without obtaining special permission from the Controller of H.M. Stationery Office or other Government official, on the condition that such privately produced small-scale maps are not mere reproductions, enlargments, or reductions of Ordnance maps, but are specially drawn or engraved.

(2) Maps thus produced by map-making firms must not bear in the title the words "Ordnance" or "Ordnance Survey," or any expression or form of words which would convey the impression that the maps are produced by official authority or have Government recognition. This applies also to endorsements on maps and to map covers, envelopes, and advertisements.

(3) In general, no direct reproduction, copy, reduction, or enlargement for publication of the whole or of any part of an Ordnance map, and no reproduction, copy, reduction, or enlargement for publication, with alterations or additions, of the whole or part of an Ordnance map, will be allowed. There are various exceptions to this general rule, however.

A copy of the whole of the rules relating to the reproduction of Ordnance maps, together with the exceptions, and the procedure to be adopted for obtaining permission to reproduce from these maps, may be obtained on application to the Director-General, Ordnance Survey, Southampton.

MISCELLANEOUS NOTES.

Importation Regulations.

Importation of Live Stock into South Africa.—Importation, under veterinary inspection, into South Africa *viâ* the ports of Cape Town and Durban, of cattle, sheep, goats, and pigs from Great Britain is now permitted, provided that such animals are accompanied by veterinary and Board of Agriculture certificates to the effect that the stock come from a locality fifteen miles from any place where there has been an outbreak of foot-and-mouth disease within the two months preceding 9th December, 1912.

The stock will be subjected to fourteen days' quarantine at the South African port of entry. No fodder may be landed with the animals.

Importation of Fruit into Western Australia.—A Proclamation of 18th July, 1912, prohibits the importation of apples, pears, and quinces into the State of Western Australia.

Importation of Hay and Straw into Australia.—A Proclamation, dated September 18th, 1912, issued under the Quarantine Act, 1908, prohibits the importation of straw or hay for fodder purposes into Australia, in consequence of it being considered likely that foot-and-mouth disease might be introduced into the Commonwealth by means of fodder (*Board of Trade Journal,* November 21st, 1912).

Transit of Plants, &c., through Italy.—As a result of representations made by the Board to the Italian Post Office through the Postmaster-General, permission has been given by the Italian authorities for the transmission through Italy of parcels containing plants, seeds, and bulbs, provided that the parcels are transmitted in sealed receptacles. This condition is fulfilled in the case of parcels for India and the Far East generally, sent in transit through Italy; and there is accordingly no longer any objection to the posting of such parcels for transmission by the overland route to India. This concession is an important one in the case of plants, &c., which suffer by delay, since there is a saving in time of at least a week by sending parcels "via Brindisi."

Notes on Agriculture Abroad.

The Norwegian Forestry Budget.—The Norwegian Forestry Budget for the current year comprises two divisions, the first relating to "private forest economy," and the second dealing strictly with the State forests.

The part relating to private forest economy consists entirely of expenses. The sum of £1,340 is provided for the primary forest schools of the State; these are three in number, and give practical instruction in forestry to youths desirous of embarking on a forestry career. There were 256 requests for admission into these schools in 1910 and 1911, of which only 96 could be granted.

The sum of £550 (including a balance from the preceding year's budget) is provided as a subvention to the forestry school of the province of Hedemark. The commune of Storelvedal placed a forest of about 6,500 acres at the disposal of the province (the most densely afforested province of Norway), for the purpose of the foundation of a forestry school. Up to the present forestry education has been given in the province at the agricultural school of Jonsberg only. The new forestry school has accommodation for twenty pupils.

Provision was made for a subvention of £7,300 to the Norwegian Forestry Society. This society, in addition to other functions, distributes the subventions of the State (notably a subsidy of 23*s.* per acre of land reafforested with protective forests). The budget also provides £146 towards the salary of the head of the office of the society. The sum of £2,430 was provided for the salaries and expenses of provincial forestry officials. Part of the duties of these officials consists in administering the forestry grants under the Norwegian Forestry Society. The officials are chosen, and part of their salaries is paid, by the provincial councils, and they are at the service of the provincial forestry societies to direct their work on afforestation, and aid both communes and private individuals in the management of their forestry estates.

Regulations have been made for an increasing number of provinces, with regard to the minimum area to be reafforested in each year. Half of the expenses incurred by the governors of the provinces in carrying out these regulations is recoverable from the State, and the sum of £450 was provided in the budget for the purpose.

The total provision in the budget for expenditure under the head of private forest economy was £12,300.

The part of the budget relating to the State forests was as follows :—

Receipts.	£	*Expenditure.*	£
Produce of the State Forests ...	54,880	Purchase of forests	2,240
Produce of the Nurseries... ...	2,016	Salaries of higher forestry officials	6,124
Proportion of the Salaries of forestry officials for the State forests	1,512	Inspection expenses	1,792
		Salaries of lower forestry officials	1,882
		Surveying and management ...	790
		Reafforestation	6,742
		Cutting, &c., expenses	19,040
		Other expenses	364
		Profit	19,434
	£58,408		£58,408

Various sums for purchasing lands for reafforestation and for subsidies for the construction of roads, amounting in all to £4,010, have been included in expenditure; excluding this sum the total profit is £23,444. If to this amount are added further sums of £27,838 for the profits on forests of public bodies, and of £11,200 for the value of wood given to commoners in public forests, the net produce of the State forests is seen to be £62,480. The area of the State forests is about 2,124,000 acres, so that the net profit is about 7*d.* per acre. Since 1895 the yield of the State forests has increased more than five-fold, their number has doubled, and their size has increased by 590,000 acres. (*Rev. des Eaux et Forêts,* July 1st, 1912.)

Prevalence of Animal Diseases in Germany in 1911.—The prevalence of rabies in 1911 declined from that in 1910 to the extent of 31·7 per cent. The number of animals which were definitely diseased, and which died or were slaughtered was 371, compared with 543 in 1910; 564 suspected animals were killed and 34 placed under supervision. Two outbreaks of the disease in 1911 were traced to imported dogs.

The number of cases of glanders also declined; there were 265 cases, compared with 290 in 1910; 302 animals died or were slaughtered; 1,005 horses and one ass were found on the 101 premises on which fresh outbreaks occurred in 1911, compared with 796 horses on 126 premises in 1910. The disease was introduced into several districts in Prussia by imported horses.

Foot-and-mouth disease increased in prevalence during 1911 in Germany to an extent not met with before. The disease existed in 1911 in 26 states (21 in 1910), 29,877 parishes (4,201 in 1910), and 250,499 premises (11,157 in 1910). Out of 1,082 "districts" in Germany 1,019 were diseased. The number of animals on the premises on which fresh outbreaks occurred was 3,366,369 cattle, 1,602,927 sheep, 53,674 goats, and 2,555,371 pigs. There were numerous instances of the introduction of the disease from foreign countries.

Swine erysipelas existed during the year in all the states of the German Empire, but was less prevalent than in 1910; 38,486 premises in all were affected, compared with 47,767 in 1910; 65,809 animals were diseased, and 45,957 died or were killed.

Swine fever also was less prevalent than in 1910; 11,639 premises were affected, as against 15,696 in 1910; 78,810 animals were attacked, and 63,223 died or were slaughtered. (*Verbreitung von Tierseuchen im Jahre* 1911.)

Measures for Combating American Gooseberry Mildew and Black Currant Mite in Ireland.—The American Gooseberry Mildew and Black Currant Mite (Ireland) Order of 1912 makes it compulsory for the occupier of any land or premises on which there is a bush which is, or appears to be, affected with either of these diseases, to notify the fact either directly or indirectly to the Department of Agriculture and Technical Instruction. The occupier of the land may be required to take various measures for the prevention of the spread of the disease. These measures may include the destruction of the fruit, bushes, packing material, &c., thorough spraying with an approved fungicide, and the close pruning and collection and burning of all prunings, with subsequent spraying. The removal of bushes out of an affected area may be prohibited.

The Order makes it unlawful to land in Ireland any currant or gooseberry bush without a license from the Department, and no such license will be given except for the importation of bushes to be used for the purpose of experiment or propagating new varieties, provided that in the case of a person or firm having a nursery in Ireland the Department at their discretion may grant to such person or firm a license for the importation of a limited number of bushes solely for the purpose of propagating new stocks in such nursery, but not for resale.

Compulsory powers of entry on any land or premises are given to inspectors for the purpose of examining fruit or bushes, and for directing the disposal of diseased fruit and bushes.

Notes on the Weather in December.

The conditions were very dull and unsettled in the *first* week (December 1st to December 7th). Snow fell over all the north-western, northern, and eastern districts early in the week, and rain was experienced almost daily in the west and north-west, and rather frequently in the south and south-east. Temperature as a whole was below the average in Scotland and England N.E., and above it elsewhere. Rainfall was below the normal over the whole country, and bright sunshine was less than the average everywhere.

Very unsettled conditions prevailed in the *second* week. Rain occurred daily in the west and north of Scotland, and on most days in the other parts of the country, while the few fair intervals were very brief. Temperature was much above the average, the divergence in the Midland Counties being rather more than 7°, and in England E. slightly more than 8°. Rainfall was more than the average except in England N.E., and in most of the western districts the excess was large. Bright sunshine was very deficient.

In the earlier half of the *third* week the weather was in a very unsettled state, with frequent rain in all districts; after the middle of the week a rather decided improvement took place in England. Warmth over the whole week was "unusual," except in Scotland N. and E.; rainfall was in excess of the normal in all districts except England N.E. and E. Bright sunshine varied considerably in amount in different parts of the country, but was, as a rule, slightly below the average.

In the *fourth* week the general condition was again unsettled, and at times extremely rough. Temperature continued above the average, the excess being nearly 9° in England E., 8° in England S.E., and more than 7° in the Midland Counties. Rainfall exceeded the average, the excess being large in almost all parts of England. Bright sunshine was below the normal in all districts.

Produce of Corn, Pulse and Hay Crops in Scotland, 1912.

The Board of Agriculture for Scotland have issued the following preliminary statement showing the estimated total produce and yield per acre of wheat, barley, oats, beans, and hay in Scotland in the year 1912, with comparisons for 1911 and the average yield per acre of the ten years, 1902–11.

Crops.	Estimated Total Produce.		Acreage.		Average Estimated Yield per Acre.		Average of the Ten Years 1902–11.
	1912.	1911.	1912.	1911.	1912.	1911.	
	Qrs.	Qrs.	Acres.	Acres.	Bush.	Bush.	Bush.
Wheat	299,576	337,599	62,369	63,506	38·43	42·53	39·64
Barley (including Bere) ...	862,299	786,351	191,632	173,617	36·00	36·23	35·65
Oats	4,556,866	4,453,512	956,561	963,498	38·11	36·98	37·31
Beans	37,039	39,089	8,421	9,463	35·19	33·05	35·61
	Tons.	Tons.			Cwts.	Cwts.	Cwts.
Hay from Rotation Grass..	643,200	652,410	423,588	437,333	30·37	29·84	32·04
Hay from Permanent Grass	248,977	226,276	166,732	171,434	29·87	26·40	29·11

Note.—The total yield of wheat, amounting to 299,576 quarters, shows a decrease of 38,023 quarters compared with last year's crop. This result is due partly to a decrease in area and partly to a decrease in the average yield per acre, which is less than that of the previous ten years, and considerably under the unusually higher figure of last season. The total yield of barley and bere amounts to 862,299 quarters, showing an increase over last year of 76,000 quarters. This rise is due to the increased acreage, as the average production per acre is slightly lower than in 1911, though somewhat higher than the normal. The yield per acre of oats is nearly a bushel higher than the average and more than a bushel over that of 1911, so that, notwithstanding a fall in the acreage since last year, the produce has risen by more than 100,000 quarters to a total of 4,556,866 quarters. Of beans, with an average yield per acre somewhat under the normal, but fully 2 bushels better than last year, the total production is about 2,000 quarters less than in 1911, as there was a reduction in area of about 1,000 acres. Taking hay from rotation grass and meadow hay together, the total crop of 892,177 tons is 13,491 tons larger than it was last year, the decrease of 9,210 tons of rotation hay being outweighed by the increase of 22,701 tons of meadow hay. The yield per acre of rotation hay was more than 1½ cwt. below the average, and that of meadow hay about ¾ cwt. above it. In both cases the yield per acre exceeded that of last year; the increase in the rotation hay was fully ½ cwt., and in meadow hay nearly 3½ cwt., this latter substantial increase more than making up for the diminished acreage of both crops.

Produce of Potato and Root Crops in Scotland, 1912.

The Board of Agriculture for Scotland have issued the following preliminary statement showing the estimated total produce and yield per acre of the potato and root crops in Scotland in the year 1912, with comparisons for 1911, and the average yield per acre of the ten years 1902–11.

Crops.	Estimated Total Produce.		Acreage.		Average Estimated Yield per acre.		Average of the Ten Years 1902–1911.
	1912.	1911.	1912.	1911.	1912.	1911.	
	Tons.	Tons.	Acres.	Acres.	Tons.	Tons.	Tons.
Potatoes ...	936,375	975,182	149,767	142,629	6·25	6·84	6·41
Turnips and Swedes	7,390,633	6,251,569	439,587	438,818	16·81	14·25	16·27
Mangolds ...	49,540	43,209	2,830	2,250	17·51	19·20	17·81

Note.—The total yield of the potato crop in Scotland is estimated at 936,375 tons, which shows a decrease of 38,807 tons as compared with last year's crop. The average yield per acre is slightly under the average of the past ten years, and less than that of last year by more than half a ton, which accounts for the total produce being diminished, notwithstanding the increase of 7,138 acres in the area. In the estimated production of turnips and swedes amounting to 7,390,633 tons, there is a rise of well over a million tons on last year's figures. There was a slight increase in the acreage of the crop, and in the average yield per acre there was a substantial increase of fully 2½ tons as compared with the low average of 1911, and of over half a ton as compared with the normal. The average yield per acre of mangolds was a little less than usual, and over 1½ tons lower than it was last year. The area, however, was increased by 580 acres, so that the total production of 49,540 tons exceeded the total of 1911 by 6,331 tons.

Agricultural Conditions during December.

The Crop Reporters of the Board, in reporting on the crops and agricultural conditions on January 1st, state that the exceptionally mild and generally wet December allowed of comparatively little progress being made with farming operations during the month. As usual in such cases, light soils or high-lying lands suffered comparatively little, and fair progress was made; but on low or heavy land work was nearly at a standstill throughout the greater part of the month. The appearance of the winter corn is generally quite satisfactory, although in some parts the excessive wet is affecting the wheat on low ground. The character of the month is reflected in the area already sown with wheat at December 31st, which is but little more than a month ago, and may be estimated as between three-fourths and four-fifths of the area intended for this crop. The area now under wheat is some 5 per cent. less than at the end of 1911, although in the southern counties at least as much has been sown as a year ago.

The seeds are, with very few exceptions, very healthy and vigorous, and are unusually forward. The exceptions are chiefly on low-lying land, where the prolonged wet has caused some damage; and from the eastern counties there come several reports of clover-fields dying off.

It is estimated that a little more than half the potato crop has already been marketed, but the estimates vary very greatly, even in contiguous districts.

The quality and condition of turnips and swedes are everywhere satisfactory; the roots are mostly small, but further growth is reported in many districts as a result of the open weather.

The condition of the ewes is generally fairly satisfactory, although the continuance of wet weather is beginning to tell against their condition, and some little apprehension as to its effects is being felt where lambing is due to commence very soon. Lambing has already begun in a few localities in the south. In the west (Devon and Gloucester) there are reports of sheep dying from fluke; while in certain districts of the midlands and the north foot-rot is giving some trouble. Other live-stock have thriven well during the month, and the mild weather has allowed of their being kept out at grass, which is plentiful, much later than usual.

Labour is generally sufficient, and in some districts abundant; though there seem to be some rather numerous exceptions in certain areas of the north, while in other districts, scattered over the country, some special kinds of labour appear to be locally scarce.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for December, 1912, issued by the International Institute of Agriculture, shows the production of the cereal crops last year from information received up to December 20th. The countries for which it is possible to give an approximate estimate of the production are as follows: In *Europe*: Germany, Austria, Belgium, Bulgaria, Denmark, Spain, France, Great Britain and Ireland, Kingdom of Hungary, Italy, Luxemburg, Norway, Netherlands, Rumania, Russia in Europe (sixty-three governments), Switzerland; in *America*: Canada, United States; in *Asia*: India, Japan, Russia in Asia (ten governments); in *Africa*: Algeria, Egypt, Tunis.

Wheat.—The total production in all the above-mentioned countries is estimated at 421,150,000 qrs., as compared with 394,016,000 qrs. in 1911, or an increase of 6·9 per cent. The area harvested is less than in 1911 by 2·8 per cent.

Rye.—The estimated production in the specified countries (excluding Great Britain, India, Japan, Egypt, and Tunis) amounts to 217,485,000 qrs., against 180,532,000 qrs. in 1911, the increase being equal to 20·5 per cent. The area under production is 0·1 per cent. greater than in 1911.

Barley.—The production in all the above countries (with the exception of India) shows an increase on 1911 of 6·1 per cent., the estimate being 174,110,000 qrs., as compared with 164,093,000 qrs. in 1911. The area planted is 0·9 per cent. below that of 1911.

Oats.—The total production in the above countries (with the omission of India and Egypt) is estimated at 463,810,000 qrs., against 385,179,000 qrs. in 1911, or an increase of 20·4 per cent. The area under production shows a decrease of 1·4 per cent.

Maize.—The estimated production in the above-named countries (excluding Germany, Belgium, Denmark, France, Great Britain and Ireland, Luxemburg, Norway, Netherlands, and India) is placed at 447,397,000 qrs., which is 21·8 per cent. more than in 1911, when the production was 367,319,000 qrs. The area planted is also greater than in 1911 by 1·8 per cent.

The following information is given concerning crops in the Southern Hemisphere:—

Argentina.—The production of wheat in 1912–13 is estimated at 29,387,000 qrs., as compared with 20,768,000 qrs. in 1911–12, and the production of oats at 11,882,000 qrs., against 7,092,000 qrs. The increase in wheat is equal to 41·5 per cent., and in oats to 67·5 per cent.

Australia.—The area from which the wheat harvest in 1912–13 will be taken is estimated to be 7,496,000 acres, or 1 per cent. more than last year. The production is estimated at 9,882,000 qrs., against 8,981,000 qrs. in 1911–12, the increase amounting to 10 per cent.

New Zealand.—The area sown with wheat in 1912–13 is estimated at 190,000 acres, with barley 37,000 acres, and with oats 387,000 acres. The area of barley is greater than in 1911–12 by 16·9 per cent., but wheat is less by 11·8 per cent., and oats by 4·1 per cent. The condition of all three crops on December 1st was average.

Sugar Beet.—The estimated total production in Prussia, Belgium, Bulgaria, Denmark, Spain, France, Croatia and Slavonia, Italy, Rumania, Russia, Sweden, and Canada amounts to 39,579,000 tons, as compared with 28,665,000 tons in 1911, the increase being equal to 38·1 per cent. The production in France is estimated at 6,911,000 tons, which shows an excess over 1911 of 65·8 per cent.

France.—The *Journal Officiel* of December 15th contains a report issued by the Ministry of Agriculture, which estimates the production of potatoes at 14,448,000 tons, as compared with 12,569,000 tons in 1911, and the production of mangolds at 24,369,000 tons, against 15,266,000 tons last year.

Germany.—The official crop estimate places the total production of potatoes in 1912 at 49,403,000 tons, as compared with 33,822,000 tons in 1911.

United States.—H.M. Consul-General at Chicago, in a report dated December 18th, 1912, states that the figures of the final revision of the crops for 1912, issued by the Government Bureau at Washington, are as follows:—Wheat, 730,267,000 bush., as compared with 621,338,000 bush. in 1911; maize, 3,124,746,000 bush., against 2,531,000,000 bush.; oats, 1,418,337,000 bush., against 922,000,000 bush.; barley, 223,824,000 bush., against 160,240,000 bush.; rye, 35,664,000 bush., against 33,119,000 bush.; buckwheat, 19,249,000 bush., against 17,549,000 bush.; flax 28,073,000 bush., against 19,370,000 bush.; potatoes, 430,647,000 bush., against 292,737,000 bush.; and hay, 64,903,000 tons, against 49,032,000 tons.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on January 1st, 1913, certain diseases of animals existed in the countries specified:—

Austria (for the period December 18th—25th).

Anthrax, Blackleg, Foot-and-Mouth Disease, (total of 86 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period November 1st—15th).

Anthrax, Blackleg, Rabies.

Bulgaria (for the period September 14th—21st).

Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Swine Fever.

Denmark (month of November).

Anthrax, Swine Erysipelas.

France (month of October).

Anthrax, Blackleg, Foot-and-Mouth Disease (3,459 "étables" in 1,130 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period December 1st—15th).

Foot-and-Mouth Disease (134 infected places in 67 parishes), Glanders and Farcy, Swine Fever.

Holland (month of November).

Anthrax, Foot-and-Mouth Disease (5 outbreaks in 2 provinces), Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (for the period December 4th—11th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 5 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period December 2nd—8th).
Anthrax, Blackleg, Foot-and-Mouth Disease (1,776 new cases entailing 32,199 animals), Glanders and Farcy, Sheep-scab, Swine Fever.

Montenegro (for the period June 15th—July 1st).
Glanders and Farcy.

Norway (month of November).
Anthrax, Blackleg.

Rumania (for the period December 5th—13th).
Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of August).
Anthrax, Foot-and-Mouth Disease (19,493 animals in 245 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period September 14th—21st).
Sheep-pox, Swine Fever.

Spain (month of October).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (1,650 animals), Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of November).
Anthrax, Blackleg.

Switzerland (for the period December 16th—22nd).
Anthrax, Blackleg, Foot-and-Mouth Disease (272 "étables" and "pâturages" entailing 3,490 animals, of which 39 "étables" were declared infected during the period), Swine Fever.

Agricultural Labour in England during December.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in December:—

There was generally only a moderate demand for labourers outside the regular farm staff during December, though in some districts where work was backward extra men were fairly well employed at such work as threshing, lifting roots, and carting manure. Rain caused a good deal of interruption in many districts, as much as ten days being lost in this way in some cases. The wet state of the land was frequently a further hindrance to employment. The supply of extra men was generally ample, and a surplus was mentioned in a number of districts; in the Midlands, however, there were several districts in which a scarcity of men was reported.

Northern Counties.—Men outside the regular farm staff were moderately well employed in these counties during December, their chief work being threshing and getting up the root crops. Such men lost time on account of rain in most districts, correspondents reporting from two to ten days as lost in this manner. Correspondents in *Yorkshire* also referred to there being less work than usual for these men at threshing and root-lifting on account of smaller crops. The supply of such men was in excess of the demand in the Ouseburn and Patrington Rural Districts.

Midland Counties.—Threshing, hedging, ditching, lifting roots, carting manure, and other work generally created a fair demand for extra men when the weather was favourable. Several days, however, were lost through rain in most districts, and the wet state of the land further hindered employment in some districts. Some scarcity of extra men was reported in several districts, including parts of the Tamworth (*Staffordshire*), Monks Kirby and Farnborough (*Warwickshire*), Daventry, Potterspury, and Wellingborough (*Northamptonshire*), Banbury (*Oxfordshire*), and Eaton Socon (*Bedfordshire*) Rural Districts. A surplus of men was, on the other hand, reported in the Hayfield (*Derbyshire*), Upton-on-Severn (*Worcestershire*), and Hitchin (*Hertfordshire*) Rural Districts. There was a scarcity of men for permanent situations in certain parts of *Shropshire, Worcestershire, Warwickshire,* and *Northamptonshire.*

Eastern Counties.—In some districts in these counties there was little or no demand for extra men, the staff of labourers usually kept by farmers being sufficient for the work to be done in December. In other districts, however, where work was backward, such men were in fair demand for threshing, root-lifting, and hedge-cutting. Labourers on outdoor work lost time through rain to the extent of six days or more in a number of districts. The supply of extra men was usually ample, but some scarcity was reported in parts of the Welton (*Lincolnshire*), Downham and Erpingham (*Norfolk*) Rural Districts. A scarcity of milkers was reported in the Bosmere and Claydon (*Suffolk*) Rural Districts.

Southern and South-Western Counties.—Rain hindered work somewhat considerably in many districts in these counties, a loss of ten days being reported in some cases. The demand for extra men was generally only moderate, as, in addition to the adverse weather conditions, the land was in many cases too wet to work upon. A surplus of such men was reported in the Guildford (*Surrey*), Uckfield (*Sussex*), Chippenham and Cricklade-and-Wootton Bassett (*Wiltshire*), Wareham-and-Purbeck (*Dorset*), and Yeovil (*Somerset*) Rural Districts. A scarcity of men for permanent situations was reported in the Blean (*Kent*), Farnham (*Surrey*), Petworth (*Sussex*), Hartley Wintney (*Hampshire*), Chippenham (*Wiltshire*), Chard (*Somerset*), Thornbury (*Gloucestershire*), Axminster (*Devonshire*), and Truro and West Penwith (*Cornwall*) Rural Districts.

THE CORN MARKETS IN DECEMBER.

C. KAINS-JACKSON.

Wheat.—The temperature of the month was consistently high, and while there were a good many rough days the wind and rain came from the south-west. Thus the effect on the demand for breadstuffs was adverse in two ways, the absolute consumption of bread being reduced, as it always is with very open weather, and the marketability of wheat samples being reduced owing to the damp feel and unfit state of the grain. The month's threshings were below the average, but, even so, must be deemed excessive, as there were hardly any days upon which the operation was advisable. The average price of English fell below thirty shillings at a formidable list of markets, including some of those which are wont to show the largest volume of trade in the course of the year. At the same time, it has to be observed that there is little to be gained in holding back damaged stuff; it is the finer corn which it pays the farmer with capital to hold. There has also been an excellent demand—at feeding prices, of course—for feeding wheat, and buyers for poultry use at 28*s.* per 448 lb. have been particularly active. It is not always noted, as it might be, that this price equals a level thirty shillings per statute quarter of 480 lb.

The price of imported wheat during December fell in an irregular manner, the sorts which were most depressed at the close being average and common Canadian, New Zealand, Russian, and Indian. Scarcity of old-crop Australian prevented much reaction in that branch of the market, and at several ports old-crop Argentine was hardly offered. The month closed at Mark Lane with the following prices accepted per 480 lb.: British Red wheat, 32*s.* to 35*s.*; British White, 34*s.* to 38*s.*; Canadian, 32*s.* to 38*s.*; Northern Spring, 37*s.* to 38*s.* 6*d.*; Red Winter, 36*s.* to 37*s.*; fine Russian, 36*s.* to 37*s.*; average Russian, 34*s.* to 35*s.*, and Indian, 37*s.* to 37*s.* 6*d.* At Liverpool closing prices per cental were: best Canadian and Indian, 7*s.* 8*d.*; Indian Red and good Russian, 7*s.* 7*d.*; No. 2 Manitoba and No. 2 Hard Winter, 7*s.* 6*d.*; average Russian and also Durum, 7*s.* 5*d.*, and No. 3 Manitoba, 7*s.* 4*d.* The new crops of Argentina and Australia were being dealt in for prompt shipment at 35*s.* and 37*s.* per 480 lb., but business was most brisk in the latter, because a dispute between Argentine shippers and British buyers over the measuring of shipments and other technical points had in the mid-month taken an acute form. It will be sufficient to state that on the issues in question the British buyers are supported by those of France, Germany, and the Low Countries, which are the three chief Continental purchasers of Argentine wheat. Shipments for December were 2,114,000 qrs. from North America, 213,000 from South America, 891,000 from Russia, 613,000 from Europe S.E., 411,000 from India, and 44,000 from Australasia. North America and India shipped somewhat above expectation, but in Russian exports there was a falling off of a remarkable character, there being no winter ice or frost to account for it, the season at all the Black Sea ports being mild, and even the Baltic ports being unusually late in closing. The supply on passage at the end of the year included 605,000 qrs. from

North American Atlantic ports, 450,000 of Californian, 430,000 of Indian, 180,000 of La Plata, 250,000 of Australasian, and 30,000 of Russian. The total was about half a million quarters less than at the end of the previous season. Stocks in the fifteen chief ports of the United Kingdom included a little over 3,000,000 qrs. of breadstuffs, against 2,025,000 qrs. at the beginning of the year, and it is this extra million quarters which, although rather less than 3 per cent. of the requirements of a twelvemonth, is responsible for a great deal of the depression which marked the December markets. There appears to be an increasing reluctance to bear warehouse and "carrying" charges, and this accentuates the effect of a spell of mild weather or any other cause which reduces the daily or weekly inquiry for actual consumption. On December 27th "Beerbohm's List" published its corrected crop estimates for the year, according to which the wheat-producing countries have 464,100,000 qrs., against 432,300,000 qrs. for the year before. Crop estimates increased from the preliminary returns (issued on August 9th) are those for the United States, France, and Germany.

Flour.—This branch of the market has not escaped financial troubles, which, however, were surmounted before Christmas and did not prove so serious as had been feared. None the less, there was an increased pressure of London flour on sale, and the country markets have also been in somewhat weak hands. The month closed with Hungarian at 38*s.*, top-price at 33*s.*, Town Whites at 30*s.* 6*d.*, Goliath at 30*s.*, Town Households at 27*s.* 6*d.*, Country Roller Whites at 25*s.*, and Stone-made at 24*s.*, all per 280 lb. American flour showed a great range, the chief feature concerning it being the liberal choice offered to buyers. Pillsbury's Best, an old favourite, was obtainable at 28*s.* 6*d.*, and very fair flour made from strong spring wheat could be had at from 27*s.* to 27*s.* 6*d.* per sack. North American shipments during December were 631,000 sacks, and 240,000 sacks were on passage on the last day of the month.

Barley.—Fine malting samples have not been absolutely absent from Mark Lane, where, whether of English, Californian, or Anatolian origin, they have commanded 42*s.* per 448 lb. But the great majority of English samples offered have been of more or less stained or discoloured grain, which, with a good August for the ingetting, would have been worth 37*s.* to 40*s.*, but which owing to unfitness for most brewers' purposes had to be parted with for about 5*s.* under those prices. Indian feeding barley has been held for 27*s.* to 28*s.*, but Russian has been obtainable at 25*s.* to 26*s.* Shipments were 848,000 qrs. from Russia, 195,000 from Europe S.E., 140,000 from India and Persia, and 312,000 from North America including California. At the close of the year 840,000 qrs., a large total, was on passage. This was made up as follows: Californian, 520,000 qrs.; Indian and Persian, 170,000 qrs.; Russian, 60,000 qrs.; Anatolian, 30,000 qrs.; and 60,0000 qrs. of feeding barley from Atlantic ports.

Oats.—There has been much discussion as to why Russia, with an estimated surplus of twenty million quarters in excess of last season, has not increased its shipments. These since harvest have been only 3,560,000 qrs., against 3,690,000 qrs. last season. The Argentine oats offered at 17*s.* 6*d.* to 18*s.* have, indeed, been a formidable rival, but then Argentina has a new crop coming forward, and offered at 15*s.* 6*d.* for

February shipment, so that the position for the Russian seller has been getting worse instead of better. America, moreover, has entered the field with free offers at 18*s.* 6*d.* to 19*s.* per qr., and the American produce is made up in weight to 320 lb., the weight of Russian and Argentine being 304 lb. only. The situation of the trade in foreign oats being more or less anomalous, developments in 1913 will be awaited with interest. The markets for British oats have escaped depression, but they have been exceedingly dull. The December shipments were 725,000 qrs. from North America, 71,000 from South America, and 703,000 from Russia. On the 31st there were 310,000 qrs. on passage, a total very little above the average. It is the large business done in Argentine new crop for early 1913 shipment which has caused imported descriptions to favour buyers.

Maize.—Imports for the first four months of the cereal year—September 1st to December 31st—have proved to be about three times as large as for the like period of last season, so that the market has naturally been a difficult one for the importer, and a good retail inquiry may fairly be argued from the fact that there has been no further fall below five shillings per cental, and that in the last week of December there was even a penny rally, 5*s.* 1*d.* being paid for cargoes on the last day of the month. Liverpool prices at the last market of the old year were, for landed maize, 5*s.* 2*d.* Argentine, 5*s.* 4*d.* West African, 5*s.* 5*d.* White Novorossisk (Caucasian), 5*s.* 7*d.* South Russian, 5*s.* 9*d.* New Orleans (first arrivals of American new), and 7*s.* 7*d.* Cinquantina: all per cental. December shipments were 119,000 qrs. from North America, 1,960,000 qrs. from South America, 37,000 qrs. from Russia, and 19,000 qrs. from Rumania. On the last day of 1912 there were just one million quarters on passage.

Oilseeds.—Indian linseed closed the year with arrived cargoes held for 47*s.* 6*d.* per 410 lb., against 49*s.* 3*d.* on December 1st, 1912, and 71*s.* on December 31st, 1911. The fall on the month therefore was 1*s.* 9*d.*, and on the year 23*s.* 6*d.*, and this remarkable decline extended to all sorts except English, which, by reason of its extreme scarcity, is only 5*s.* to 6*s.* down on the year. The effect of this fall on the market for oilcake is, of course, very encouraging to those who have stock to fatten. December shipments of linseed were 180,000 qrs. from North America, 101,000 from South America, 68,000 from India, and 30,000 from Russia, but only 102,000 qrs. were on the 31st on passage to this country. Germany is a strong competitive buyer. Cottonseed in December lost ground, but the quantity on passage with which the year closed, 39,000 tons, was not very large, and reduced shipments from India balanced the increase in the shipping energies of Alexandria.

Various.—A considerable trade has been done at Mark Lane in such minor staples as gram, muttor, Manchurian beans, Rangoon beans, Persian dari and yellow millet; Bristol and Southampton also do a good business in these varied products. Beet sugar at 9*s.* 6*d.* to 9*s.* 8*d.* per cwt. has had a steady sale. Canary seed has risen to 75*s.* for Turkish, largely on account of the war. Rice has not been so firm as in November, and forward quotations are lower. There has been a crisis in the oatmeal trade, as contracts to deliver the meal could not always be performed for want of the oats; meal guaranteed made from Scotch oats has been particularly difficult to secure. The Scotch crop was very late in harvesting, and has come slowly to market since then, partly owing to unfavourable weather for threshing. The business in condiments, as is usual after a chill and damp summer, is above the average; aniseed at 26*s.* and carraway seed at 32*s.* per cwt. are typical produce in this small section of the market.

THE LIVE AND DEAD MEAT TRADE IN DECEMBER.

A. T. MATTHEWS.

Fat Cattle.—The month of December is always one of great interest in the cattle trade, for it not only marks the change from grass to stall-fed animals at most markets, but it covers that important period of Christmas shows and special markets for which feeders have been long preparing their best cattle. Most of these events take place in the second and third weeks, and as the quality of the stock then offered is far better than usual, and the demand much greater, it is reasonable to look for higher average prices. These generally occur, and this year there was no exception to the rule, for the average prices in all English markets were fully ½*d.* per lb. higher in the second and third weeks than in the first week and during November.

Supplies have rather exceeded those of last year at this time, and have been well up to the usual level of recent years, while prices for Christmas beef have been somewhat better than in 1911, though in some markets, including that of London, they scarcely equalled expectations. The leading feature at Islington great market was the splendid show of 800 Devons, which were greatly admired for their quality and condition, and sold at the top prices of the day, some of them making 9*s.* 11*d.* per 14 lb. stone. This figure was not exceeded even by the best Aberdeens, of which on this occasion there were only 250.

Probably owing to the absence of Irish stores, there has been a visible increase this season in the feeding of very young bullocks, and the writer has been struck with the large number of two-year-olds appearing at market during the past month. In a sense this may be mortgaging next year's supplies, but it may give an impetus to the movement for "early maturity" which is often so strongly advocated.

It may be worth recording here that for many weeks past there have been extensive purchases at Islington of fat cows and bulls for export to Belgium, forming a new feature in the trade for that class of cattle.

The December averages for the various breeds were as follows: Shorthorns, 8*s.* 10*d.* and 8*s.* 1*d.* for first and second quality, against 8*s.* 7*d.* and 7*s.* 9*d.* in November; Herefords, 8*s.* 11*d.* and 8*s.* 3*d.*, against 8*s.* 8*d.* and 8*s.* 1*d.*; Devons, 8*s.* 11*d.* and 8*s.*, against 8*s.* 6*d.* and 7*s.* 10*d.*; Welsh Runts, 8*s.* 10*d.* and 8*s.* 2*d.*, against 8*s.* 4*d.* and 7*s.* 9*d.*; and Polled Scots, 9*s.* 3*d.* and 8*s.* 6*d.*, against 8*s.* 10*d.* and 8*s.* 2*d.* per 14 lb. stone.

Veal Calves.—The demand for veal calves was very good for the time of year, and prices were higher than last year at the corresponding date, showing also an advance on those of November. The averages were 9*d.* and 8*d.* for first and second quality.

Fat Sheep.—As was anticipated, there has been a decided, though not an extensive, advance in the value of sheep over that of November. Supplies of turnip-fed tegs have been fairly good, but the absence of Irish and (in southern markets) of Scotch, has strengthened the position of English sellers. It is unusual for values to improve just before Christmas as they did this year in so many English markets. At Islington on the 16th over 8,000 sheep were penned, yet prices improved by ¼*d.* per lb. At Nottingham and Salford prime Downs were quoted at 10*d.* per lb., the average that week in twenty-one English markets being 9¼*d.* per lb. for first quality of that breed.

The great demand and gradually hardening prices for wool should prove an important factor in the trade for fat sheep, and prospects for feeders this winter must be regarded as favourable.

The averages for the sheep classed as Downs in about twenty English markets during December were 9¼*d.*, 8¼*d.*, and 6¾*d.* per lb., and for Longwools 8¼*d.*, 7¾*d.*, and 6¼*d.* for the three qualities.

Fat Pigs.—The long-continued gradual advance in bacon pigs received a check in the first two weeks, but in the third there was a recovery, and the average prices for December in about thirty British markets were 8*s.* per 14 lb. stone for prime small, and 7*s.* 4*d.* for second quality.

Carcass Beef—British.—All fresh-killed beef met a quiet trade in the London markets, Scotch making but little more than the best English, the offerings of the latter having improved in quality compared with those of November. Still prices showed some advance, Scotch to the extent of about 1*d.* per 8 lb., English 6*d.*, and Irish 5*d.* Scotch short sides fetched 4*s.* 8*d.* to 5*s.*, and long 4*s.* 3*d.* to 4*s.* 6*d.*; English 4*s.* to 4*s.* 4*d.*, and Irish 3*s.* 8*d.* to 4*s.* per stone. A fair clearance was made of the Christmas supplies.

Chilled Beef.—Argentine chilled, not being too heavily supplied, met a good steady demand, with prices tending upwards all the month. The average for hindquarters was about 3*s.* 6*d.* and 3*s.* 2*d.* for first and second quality, and 2*s.* 7*d.* and 2*s.* 5*d.* per stone for forequarters. Some very fine quarters from animals exhibited at the Palermo show were much admired, and some of the hindquarters fetched 4*s.* per stone, and the condition of the Christmas supplies from Argentina was generally good.

Frozen Beef.—There was no extra Christmas demand for frozen beef, and the trade remained very quiet at steady prices, hinds making 2*s.* 4*d.* to 2*s.* 6*d.* and fores 2*s.* to 2*s.* 1*d.* per stone.

Carcass Mutton—Fresh-killed.—The fresh-killed mutton trade has been rather dull and featureless, with prices very similar to those of November. Scotch teg carcasses of very light weight have been worth 8*d.* per lb., except in the second week, when they declined ½*d.*, while prime wethers have seldom made more than 7*d.* West Country English tegs have averaged 4*s.* 7*d.* and 4*s.* 3*d.* per 8 lb. in the Central Market, while Dutch mutton has made 3*s.* 10*d.* to 4*s.* 4*d.*, according to quality.

Frozen Mutton and Lamb.—There has been, relatively, a better trade for frozen mutton than for fresh-killed, and prices gradually advanced. There has been scarcely any Australian on offer, and New

Zealand averaged 3*s.* 3*d.* and 3*s.* for first and second quality, Argentine fetching 3*s.* 1*d.* and 2*s.* 9*d.* These figures represent about 3*d.* per 8 lb. stone over those of November. New Zealand and Argentine lamb has met with a moderate demand at 3*s.* 8*d.* to 4*s.* for the former and 3*s.* 4*d.* to 3*s.* 7*d.* for the latter.

Veal.—Really good veal has been unusually scarce and has fetched high prices in London. A prime calf should weigh about 16 stones of 8 lb., and the few of these available have easily made 9*d.* per lb. The week before Christmas some English carcasses made 10*d.*, and the best Dutch 10½*d.* per lb.

Pork.—Demand for pork was good, and, the market being only moderately supplied, prices have generally been about 5*s.* 4*d.* for prime small and 5*s.* for medium carcasses.

THE PROVISION TRADE IN DECEMBER.

HEDLEY STEVENS.

Bacon.—The year 1912 has not been a very profitable one, especially to those who import freely all descriptions of American hams, the wet summer considerably curtailing the consumption of that cut, and hence stocks accumulated and lower prices had to be accepted to effect a clearance. Contracts made early in the year for other American cuts, for shipment during the summer months, proved more profitable to the British buyer.

Prices for long sides were mostly lower at the commencement of the month of December, but by the third week, with the improved demand for the Christmas requirements, quotations advanced several shillings per hundredweight, the greatest advance being on Danish and Irish long sides, some brands of which on the month advanced from 3*s.* to 5*s.* per cwt. These final prices are from 17*s.* to 20*s.* above prices current at the same time last year, but it is thought by many traders that there will be little, if any, reduction in quotations for the next two or three months. The arrivals of long sides from Russia have been moderate, and readily consumed, at comparatively good prices. The out-turn of this class of bacon has greatly improved during the past twelve months.

Further arrivals of bacon from East Africa have reached London during the month, and realised from 62*s.* to 64*s.* per cwt., proving the quality and condition to be satisfactory. Trading in American bacon and hams has been only moderate for the month, and in the case of two or three cuts, prices were unduly inflated through scarcity. Importers of American hog products report their stocks as smaller than for some years past, and on account of the high prices demanded for future shipments, very little contracting has resulted. The receipts of hogs at the packing centres have been larger during the month, possibly because of the breeders' fear of hog cholera; the output for later months will therefore probably be reduced. At Chicago prices of hogs during the month ranged from $6.80 to $7.60, against $5.40 to $6.40 last year, and $7.00 to $7.85 two years back.

The demand for English pigs has been good during the month, at steady prices.

Cheese.—The season's business has been very different from that of 1911, when, on account of the dry weather in practically all producing countries, the make of cheese was smaller than usual, and prices were abnormally high, rising to 74–78*s*. in the spring for old Canadian and New Zealand makes, while at the same time English realised very extreme prices. The new season consequently opened high, and kept on a higher basis than the wet and cold summer weather warranted, the make being larger and the consumption less. Importers of Canadian and New Zealand makes at the end of December stood to lose money on their stocks, but it is thought by some that the markets may advance early in the New Year. Present prices are 8*s*. to 10*s*. per cwt. below those current at the same time last year.

The demand for all descriptions of cheese throughout December has been only moderate, and prices on the month show little if any change. New Zealand makes are now arriving more freely in London, the stocks at the end of the month being 16,500 crates (two cheese in each), against 2,500 crates at the same time last year. Stocks of Canadian cheese at the three principal distributing centres (London, Liverpool and Bristol) at the end of the month were 309,000 boxes, against 262,000 boxes at the end of December, 1911, and 404,000 boxes in 1910.

Butter.—The year 1912 opened with New Zealand makes realising about 135*s*. per cwt., and values of all descriptions remained high until well into the spring. With the advent of new home makes, prices fell somewhat, but remained high throughout the year, considering that the home make was larger, while there was a very large make in Ireland. Prices being high in Canada throughout the season, only 27 cwt. were exported to England, though in the previous season the total shipments from Canada were 134,500 packages.

The trade during December has been of a disappointing nature, most dealers operating from hand to mouth. Those interested in dearly contracted Colonials have tried to force up prices, but without any appreciable result, for though during the month there were some fluctuations, the quotations at the commencement and the end of the month were practically the same. The demand has been mostly for best selections, secondary qualities being neglected. At the end of the month prices were from 10*s*. to 15*s*. below those current at the same time last year. Up to the end of December arrivals from the Colonies were below those of last season.

In Canada and the United States prices for butter are above an export basis. Some shipments of New Zealand have already been made to Canada from England and others seem likely to follow; these would be mostly consigned to the North-West for consumption.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of December, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle :—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	9 3	8 6	45 2	41 2
Herefords	8 11	8 3	—	—
Shorthorns	8 10	8 1	44 1	40 4
Devons	8 11	8 0	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	9	8	9¼	7¼
Sheep :—				
Downs	9¼	8¼	—	—
Longwools	8½	7¾	—	—
Cheviots	9½	8¾	9½	8
Blackfaced	9½	8½	8¾	7½
Cross-breds	9¼	8¼	9½	8½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Bacon Pigs	8 1	7 7	7 8	6 7
Porkers	8 7	8 0	8 2	7 1
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ *s.*	£ *s.*	£ *s.*	£ *s.*
Shorthorns—In Milk ...	24 2	20 4	25 11	21 12
,, —Calvers... ...	23 10	19 7	23 18	20 9
Other Breeds—In Milk ...	21 7	17 10	23 18	18 17
,, —Calvers ...	19 0	14 15	23 6	19 15
Calves for Rearing	2 6	1 16	2 18	2 2
Store Cattle :—				
Shorthorns—Yearlings ...	10 16	9 6	13 12	10 19
,, —Two-year-olds...	15 12	13 10	20 1	16 0
,, —Three-year-olds	19 3	16 13	23 0	—
Polled Scots—Two-year-olds	—	—	19 2	17 0
Herefords— ,,	15 19	14 5	—	—
Devons— ,,	14 10	12 15	—	—
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Downs or Longwools ...	41 7	35 8	—	—
Scotch Cross-breds ...	—	—	33 8	28 8
Store Pigs :—				
8 to 10 weeks old	19 4	14 10	21 4	17 1
12 to 16 weeks old	30 5	23 4	—	21 0

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of December, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Liverpool.		London.		Manchester.		Edinburgh.		Glasgow.	
		per cwt. *s.*	*d.*	per cwt. *s.*	*d.*	per cwt. *s.*	*d.*	per cwt. *s.*	*d.*	per cwt. *s.*	*d.*	per cwt. *s.*	*d.*
BEEF :—													
English	1st	56	0	53	6	60	6	55	0	65	0*	68	6*
	2nd	51	6	50	6	57	0	51	6	59	6*	63	6*
Cow and Bull ...	1st	49	0	46	6	46	6	48	6	52	0	47	6
	2nd	43	6	40	0	42	6	43	0	45	0	38	6
Irish :—													
Port Killed ...	1st	52	6	52	6	56	0	53	0	57	6	58	0
	2nd	47	0	49	0	51	6	48	6	51	0	50	6
Argentine Frozen—													
Hind Quarters...	1st	35	0	35	0	34	6	35	0	35	0	34	6
Fore ,, ...	1st	30	6	30	6	29	0	30	6	30	6	30	0
Argentine Chilled—													
Hind Quarters...	1st	46	6	44	0	46	6	45	0	46	6	44	0
Fore ,, ...	1st	35	0	33	6	35	0	34	0	35	6	34	0
Australian Frozen—													
Hind Quarters...	1st	34	6	32	6	33	6	32	6	—		33	6
Fore ,, ...	1st	30	0	28	0	29	0	28	6	—		29	6
VEAL :—													
British	1st	—		81	6	84	6	81	6	—		70	0
	2nd	71	6	73	6	73	0	76	0	—		65	6
Foreign	1st	—		—		87	6	—		80	6	70	0
MUTTON :—													
Scotch	1st	—		75	0	74	6	75	6	70	6	71	6
	2nd	—		71	0	70	0	73	0	59	6	54	0
English	1st	68	0	69	6	65	6	71	6	—		—	
	2nd	59	0	64	0	60	6	66	0	—		—	
Argentine Frozen ...	1st	42	0	42	6	42	6	42	6	42	0	39	6
Australian ,, ...	1st	40	6	39	6	39	6	39	6	—		38	0
New Zealand ,, ...	1st	—		—		46	0	—		—		—	
LAMB :—													
New Zealand ...	1st	56	6	55	0	55	6	55	6	—		53	6
Australian	1st	51	6	49	6	—		50	0	—		49	0
Argentine	1st	49	0	47	0	50	0	47	6	—		49	0
PORK :—													
British	1st	75	0	74	6	73	6	76	6	69	6	65	0
	2nd	67	6	65	6	68	6	71	6	60	6	60	6
Foreign	1st	—		—		70	0	—		—		—	

* Scotch.

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6 ..	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
,, 13 ...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
,, 20 ..	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
,, 27 ...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3 ..	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
,, 10	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
,, 17 ..	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
,, 24 ...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2 ...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
,, 9 ...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
,, 16 ..	32	6	30	1	34	0	23	6	24	11	31	2	18	0	17	6	21	8
,, 23 ..	32	9	30	2	34	1	23	7	25	0	31	10	17	11	17	5	21	9
,, 30 . .	33	0	30	3	34	4	23	8	24	11	30	3	18	0	17	5	21	8
Apl. 6 ..	33	6	30	4	34	10	23	1	24	7	30	9	17	11	17	7	21	11
,, 13 ...	33	7	30	3	35	4	23	5	25	2	30	2	18	3	18	3	22	1
,, 20 .	33	7	30	4	36	7	23	0	25	5	29	11	18	3	17	10	22	4
,, 27 ...	33	0	30	11	37	10	22	10	25	5	30	4	18	3	18	3	22	9
May 4 ...	32	6	31	4	38	1	22	7	25	7	30	2	18	2	18	6	23	1
,, 11 ...	32	1	31	8	37	11	22	0	25	1	31	1	18	1	19	0	23	7
,, 18 ..	31	10	32	6	37	8	21	8	25	4	31	2	17	8	19	2	23	7
,, 25 ...	31	3	32	8	37	2	21	4	25	0	31	1	17	10	19	5	23	7
June 1 ...	30	2	32	5	36	10	21	8	24	10	30	0	17	10	19	5	23	9
,, 8 ..	29	1	32	4	36	11	20	9	25	7	29	11	17	10	19	7	24	0
,, 15 ...	29	0	32	3	37	0	18	11	23	11	30	8	18	0	19	8	23	10
,, 22 ...	29	4	31	11	37	5	20	1	23	9	30	8	17	9	19	10	24	0
,, 29 ...	29	9	31	10	37	10	19	11	24	5	30	2	17	7	19	9	23	11
July 6 ...	30	4	32	1	38	2	19	5	25	10	31	7	17	4	19	9	23	11
,, 13 ...	31	1	32	3	38	3	21	3	25	10	30	2	17	7	19	11	24	1
,, 20 ...	31	11	32	5	38	10	19	9	24	3	30	9	17	5	19	5	24	8
,, 27 ...	33	5	32	5	38	9	20	10	23	8	30	9	18	1	19	7	23	4
Aug. 3 ...	33	9	32	0	38	4	20	5	24	4	28	6	18	3	18	2	22	2
,, 10 ...	33	5	31	6	39	2	20	4	26	9	30	7	18	0	18	0	22	4
,, 17 . .	32	11	31	6	38	2	20	11	27	8	28	3	17	11	17	10	21	8
,, 24 ...	32	7	31	8	35	6	20	10	28	10	28	1	17	2	18	0	20	10
,, 31 ...	32	2	31	7	34	10	22	10	28	4	28	6	17	2	18	3	20	8
Sept. 7 ...	31	11	31	10	35	1	23	3	28	4	29	9	17	2	18	1	21	8
,, 14 ...	30	11	32	0	33	5	24	3	29	0	29	0	16	6	18	5	20	5
,, 21 ...	30	2	32	4	32	7	24	2	29	11	29	6	16	3	18	9	19	10
,, 28 ...	30	1	32	6	31	7	24	4	30	5	29	9	16	4	19	1	19	5
Oct. 5 ..	30	1	32	7	31	8	24	7	30	9	29	7	16	3	19	5	19	8
,, 12 ..	30	2	32	9	31	10	25	1	31	0	30	4	16	2	19	10	19	5
,, 19 ...	30	4	32	9	32	2	25	3	31	5	30	11	16	1	19	11	19	9
,, 26 ..	30	4	33	1	33	1	25	4	31	7	31	6	16	2	20	6	19	10
Nov. 2 ...	30	4	33	4	33	4	25	6	31	10	31	10	16	2	20	8	20	1
,, 9 ..	29	11	33	4	33	1	25	4	32	7	31	11	15	11	20	11	19	11
,, 16 ...	29	8	33	1	32	10	25	1	32	10	31	2	16	1	21	0	19	9
,, 23 ...	29	11	33	0	32	1	24	10	33	5	30	11	16	4	20	10	19	11
,, 30 ...	30	6	32	10	31	9	24	7	33	10	30	8	16	7	20	11	19	8
Dec. 7 ...	30	9	32	9	31	0	24	3	34	0	29	11	16	9	20	9	19	6
,, 14 ...	30	7	32	11	30	8	23	9	33	5	29	2	16	10	20	9	19	3
,, 21 ...	30	7	32	9	30	7	23	10	33	5	28	11	16	9	20	8	19	1
,, 28 ...	30	5	33	0	29	10	23	9	33	4	28	6	16	9	20	7	19	2

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.				BARLEY.				OATS.			
		1911.		1912.		1911.		1912.		1911.		1912.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
France:	November	43	3	47	1	27	11	30	5	22	2	24	1
	December	43	4	46	9	28	2	30	3	22	4	23	10
Paris:	November	43	9	49	1	27	3	31	5	22	11	24	9
	December	44	2	48	4	27	7	31	5	23	2	24	4
Belgium:	October	34	1	35	8	27	7	30	10	22	4	25	2
	November	33	10	35	1	27	11	31	2	22	9	24	3
Germany:	October	43	3	43	6	34	4	34	3	25	0	24	3
	November	42	9	42	3	35	1	32	7	25	0	24	0
Berlin:	October	43	10	45	4	—		—		25	7	26	0
	November	43	7	44	1	—		—		25	2	25	5
Breslau:	October	40	4	40	8	30 25	10* 1†	32 28	5* 10†	23	7	27	8
	November	39	9	39	11	32 27	6* 7†	32 28	4* 5†	23	6	23	8

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of December, 1911 and 1912.

—	WHEAT.				BARLEY.				OATS.			
	1911.		1912.		1911.		1912.		1911.		1912.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
London...	34	0	31	1	31	10	29	2	22	2	20	4
Norwich	32	7	32	4	33	7	27	0	21	3	19	9
Peterborough	32	4	27	4	32	1	26	8	20	11	16	10
Lincoln...	32	10	27	11	33	5	30	1	20	7	18	11
Doncaster	32	10	28	6	33	5	30	1	20	5	19	1
Salisbury	32	1	30	7	33	1	30	9	20	4	18	11

CORN PRICES:—ANNUAL AVERAGES.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Weekly Averages of Corn Returns from the Returning Markets, together with the QUANTITIES returned as sold at such Markets during each of the Years 1906 to 1912.

YEARS.	PRICES.			QUANTITIES.		
	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
	s. d.	s. d.	s. d.	Quarters.	Quarters.	Quarters.
1906... ...	28 3	24 2	18 4	2,684,101	3,210,995	1,011,931
1907... ...	30 7	25 1	18 10	2,722,847	3,317,521	1,374,260
1908	32 0	25 10	17 10	3,293,506	3,293,916	1,304,223
1909... .	36 11	26 10	18 11	2,641,225	2,699,628	905,983
1910... ...	31 8	23 1	17 4	3,072,523	3,205,203	791,121
1911... ...	31 8	27 3	18 10	3,140,257	3,123,986	858,341
1912... ..	34 9	30 8	21 6	2,365,596	2,165,572	630,755

AVERAGE VALUE per IMPERIAL QUARTER OF WHEAT IMPORTED into the UNITED KINGDOM from the undermentioned Foreign Countries and British Possessions in the years 1910, 1911, and 1912.

Countries from which consigned.	Average Value per Imperial Quarter.		
	1910.	1911.	1912.
	s. d.	s. d.	s. d.
Argentine Republic	34 11	33 4	35 6
Bulgaria	33 0	35 1	—
Chile	33 7	33 0	36 9
Germany	36 11	33 6	36 8
Persia	36 2	34 6	—
Roumania	34 2	34 7	37 3
Russia	35 7	33 4	37 6
Turkey	30 0	27 3	35 8
U.S. of America	37 3	34 9	35 9
Australia	37 2	34 10	38 5
British East Indies..	35 5	33 7	37 0
Canada	36 9	34 10	35 2
New Zealand	32 7	32 11	37 4

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of December, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ..	15 3	14 3	—	—	17 0	15 6	16 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	117 0	114 0	—	—	116 0	113 0	—	—
,, Factory ...	106 0	95 0	104 6	94 6	105 0	99 0	—	—
Danish ...	—	—	132 6	129 6	131 6	129 0	128 6	—
French ...	—	—	—	—	130 0	124 6	—	—
Russian ...	112 0	106 0	109 6	105 6	111 6	109 6	—	—
Australian ...	119 0	115 0	118 6	116 0	117 6	115 6	119 0	115 0
New Zealand	123 6	120 6	124 6	122 6	123 0	119 6	126 0	—
Argentine ...	117 0	115 0	117 6	115 6	115 0	113 0	—	—
CHEESE :—								
British—								
Cheddar ...	77 0	72 0	74 0	72 0	76 0	71 6	69 0	67 0
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	75 0	70 0	80 6	72 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	65 0	62 0	64 6	61 6	64 6	63 0	64 0	—
BACON :—								
Irish	71 0	67 0	69 6	67 0	71 0	69 0	75 0	—
Canadian ...	67 0	65 6	66 0	63 6	67 6	65 6	67 0	65 0
HAMS :—								
Cumberland ...	—	—	—	—	110 0	103 0	—	—
Irish	—	—	—	—	113 0	101 6	91 0	89 0
American (long cut)	71 6	66 6	69 0	66 6	69 0	65 6	68 0	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	17 6	—	—	—	17 6	15 2	20 7	—
Irish	14 10	14 3	14 7	13 2	15 7	13 10	14 8	13 8
Danish ...	—	—	14 8	13 10	16 0	14 1	15 10	—
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
Edward VII.	98 0	83 0	75 0	71 6	100 0	90 0	—	—
Langworthy ...	104 0	95 0	95 0	90 0	110 0	100 0	68 0	61 6
Up-to-Date ...	90 0	79 6	71 6	68 6	96 0	83 0	60 0	54 0
HAY :—								
Clover ...	109 0	90 0	117 6	95 0	130 0	103 0	82 6	77 6
Meadow ...	100 0	80 0	—	—	119 6	97 0	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	DECEMBER.		TWELVE MONTHS ENDED DECEMBER.	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	42	79	743	908
Animals attacked	46	89	840	1,123
Foot-and-Mouth Disease :—				
Outbreaks	1	1	83	19
Animals attacked	9	20	645	487
Glanders (including Farcy) :—				
Outbreaks	7	12	173	209
Animals attacked	7	27	314	504
Parasitic Mange :—				
Outbreaks	248	—	2,871	—
Animals attacked	543	—	6,066	—
Sheep-Scab :—				
Outbreaks	40	76	302	434
Swine-Fever :—				
Outbreaks	192	189	2,920	2,466
Swine Slaughtered as diseased or exposed to infection	2,341	2,701	39,653	30,434

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	DECEMBER.		TWELVE MONTHS ENDED DECEMBER	
	1912.	1911.	1912.	1911.
Anthrax :—				
Outbreaks	—	—	3	9
Animals attacked	—	—	3	16
Foot-and-Mouth Disease :—				
Outbreaks	—	—	68	—
Animals attacked	—	—	380	—
Glanders (including Farcy) :—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	3
Parasitic Mange :—				
Outbreaks	6	6	66	60
Sheep-Scab :—				
Outbreaks	35	33	373	342
Swine-Fever :—				
Outbreaks	8	27	212	175
Swine Slaughtered as diseased or exposed to infection	56	221	1,691	2,568

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneou

*Pammel, L. H.**—A Manual of Poisonous Plants; Chiefly of Eastern North America, with Brief Notes on Economic and Medicinal Plants. (977 pp.) Cedar Rapids, Iowa: The Torch Press, 1911. [63.25.]

Wyoming Agricultural Experiment Station.—Bull. 70:—Wyoming Forage Plants and their chemical composition. Studies No. 2. (75 pp.) Laramie, 1906. [58.19.]

Hawaii Agricultural Experiment Station.—Press Bull. 38:—The Use of Dynamite in Farming. (7 pp.) Honolulu, 1912. [63.196.]

New South Wales, Department of Agriculture.—Science Bull. 1:—Soils in relation to Geology and Climate. [2nd Impression.] (31 pp.) Sydney, 1912. [63.11(04).]

Schultz.—Die Kalidüngung auf leichtem Boden. [Vierte Auflage.] (99 pp.) Berlin: Paul Parey, 1903. 1 M. 60 Pf. [63.1673.]

Fruwirth, Dr. C.—Das Unkraut und seine Bekämpfung auf dem Ackerland. [Landwirtschaftliche Hefte, Heft 3.] (48 pp.) Berlin: Paul Parey, 1912. 80 Pf. [63.259(04).]

U.S. Department of Agriculture, Bureau of Animal Industry.—Circ. 203:—A method for the determination of starch in meat food products. (6 pp.) Washington, 1912. [543.1.]

Radford, G.—On Book-keeping. [Our Land Reprints.—II.] (18 pp.) Westminster: P. S. King & Son, n.d. 3*d.* net. [657.]

Bangor, University College of North Wales.—Bull. 1, 1912:—Experiments on the destruction of charlock in corn and beans, 1912. (7 pp.) Bangor, 1912. [63.259.]

*Garnett, Frank W.**—Westmorland Agriculture, 1800–1900. (302 pp. + plates.) Kendal: Titus Wilson, 1912. 25*s.* net. [63(42).]

Hendrick, J.—The Progress of Agricultural Education in Scotland. [Inaugural Address delivered in Marischal College, 10th October, 1912.] (22 pp.) Aberdeen, 1912. [37(41).]

Field Crops—

Pusa, Agricultural Research Institute.—Bull. 30:—Report on the Flax Experiments conducted at Dooriah during the year 1911–12. (8 pp.) Calcutta, 1912. [63.34111.]

Montana Agricultural Experiment Station.—Bull. 89:—Grain Investigations with Wheat, Oats and Barley. (209–230 pp.) Bozeman, Montana, 1912. [63.31.]

East Anglian Institute of Agriculture, Chelmsford.—Report on Experimental Trial Plots of Winter Wheat. (4 pp.) Chelmsford, 1912. [63.311.]

British Columbia, Department of Agriculture.—Bull. 40:—The Cultivation of Alfalfa. (11 pp.) Victoria, B.C., 1912. [63.33(*c*).]

Armstrong College, Newcastle-on-Tyne.—Bull. 9:—Report on Old Land Hay Experiments at Westmorland Centres. (14 pp. + tables.) [63.33–16.]

Balls, W. L.—The Cotton Plant in Egypt: Studies in Physiology and Genetics (xi. + 202 pp.) London: Macmillan & Co., 1912. 5*s.* net. [63.341.]

U.S. Department of Agriculture, Bureau of Statistics.—Circ. 34:—Rice Crop of the United States, 1712–1911. (11 pp.) Washington, 1912. [63.31 : 31.]

Humphries, A. E.—Home-grown wheat. [Journal of the Farmers' Club, May, 1912.] (63–84 pp.) London: Wyman & Sons. 6*d.* [63.311.]

Geerligs, H. C. P.—The World's Cane Sugar Industry, Past and Present. (399 pp. + 7 plates + maps.) Altrincham (Manchester): Norman Rodger, 1912. 12*s.* net. [63.3431.]

Osborne, Thomas B.—The Proteins of the Wheat Kernel. (119 pp.) [Carnegie Institution of Washington Publication, No. 84.] Washington, 1907. $0.75. [63.311.]

Michigan Agricultural Experiment Station.—Bull. 268:—Wheat Improvement. (15 pp.) East Lansing, Michigan, 1912. [63.311.]

Bedfordshire County Agricultural Education Committee.—Report upon the Wheat Plots, 1912. (4 pp.) 1912. [63.311.]

Horticulture—

Hosking, A.—School Gardening, with a Guide to Horticulture. (326 pp. + 1 plan.) London: W. B. Clive (University Tutorial Press, Ltd.), 1912. 3s. 6d. [63.5(07).]

Plant Diseases—

Germany, K. Biologische Anstalt für Land- und Forstwirtschaft, Mitteilungen. Heft 13:—Krankheiten und Beschädigungen des Tabaks. (128 pp.) Berlin, 1912. [63.24-34; 63.27-34.]

Smith, J. B.—Economic Entomology for the Farmer and Fruit-Grower, and for use as a text-book in agricultural schools and colleges. [2nd edition.] (475 pp.) Philadelphia and London: J. B. Lippincott Co., 1906. $2.50. [63.27(02).]

Canada, Department of Agriculture, Experimental Farms.—Bull. 10 [2nd Series]:—The Large Larch Sawfly [*Nematus erichsonii*], with an account of its parasites, other natural enemies, and means of control. Ottawa, 1912. [63.27.]

U.S. Dept. of Agriculture, Bureau of Entomology.—Bull. 115, Part II.:—Papers on Deciduous Fruit Insects and Insecticides: The One Spray Method in the Control of the Codling Moth and the Plum Curculio. (85-112 pp. + 1 plate. Washington, 1912. [63.27.]

New Hampshire Agricultural Experiment Station.—Bull. 161:—Fungicides in the Apple Orchard. (15 pp.) Durham, N.H., 1912. [63.24-41.]

Live Stock—

Wood, J. T.—The Puering, Bating and Drenching of Skins. (300 pp.) London: E. & F. N. Spon, 1912. 12s. 6d. net. [675.]

South Dakota Agricultural Experiment Station.—Bull. 114:—Digestion Coefficients of Grains and Fodders. Experiments with Sheep. (525-554 pp.) Brookings, 1909. [612.394; 63.604(*a*).]

Illinois Agricultural Experiment Station.—Bull. 158:—Relative Economy, Composition, and Nutritive Value of the various cuts of beef. (133-233 pp.) Urbana, 1912. [63.751.]

Texas Agricultural Experiment Stations.—Bull. 150:—Composition and Digestibility of the Ether Extracts of Hays and Fodders. (29 pp.) College Station, Brazos County. [543.1; 612.394.]

Wisconsin Agricultural Experiment Station.—Bull. 224:—Selecting Steers for feeding. (30 pp.) Madison, 1912. [63.62.]

U.S. Department of Agriculture, Bureau of Animal Industry.—Bull. 159:—Feeding beef cattle in Alabama. (56 pp.) Washington, 1912. [63.62.]

New Hampshire Agricultural Experiment Station.—Bull. 160:—Some Data on the Inheritance of Horns in Sheep. (35 pp.) Durham, N.H., 1912. [575.1; 63.63(04).]

Wilson, James.—The Principles of Stock-Breeding. (146 pp.) London: Vinton & Co., 1912. [575.4; 63.603.]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P. 10-9. 6,000. 1/13. R. C. & S., Ltd.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE

Vol XIX. No. 11.

FEBRUARY, 1913.

AGRICULTURAL CO-OPERATIVE CREDIT SOCIETIES AND JOINT STOCK BANKS.

On the 14th January last the President of the Board made the following announcement in the House of Commons:—

> "The Board of Agriculture and Fisheries have been in communication with the leading Joint Stock Banks which have branches in the rural districts, with regard to the assistance which the Banks can offer, in accordance with ordinary banking principles, to registered Co-operative Credit Societies, consisting mainly of small holders and allotment holders.
>
> "The Banks named below are willing that the Manager of any of their country branches should have permission to assist in the formation of such a society; with liberty to give advice to its officers on matters of book-keeping; and to take part, when requested, in the audit of the annual return without remuneration. They will also favourably consider the acceptance by their Managers of the post of unpaid Treasurer, provided that it does not involve membership of the Society.
>
> "These Banks are prepared to allow to such a Society as good rates as possible for money in their hands.
>
> "They will also be prepared to give favourable consideration to applications from such societies for advances, but will require in each case to be satisfied as to the security for the loan, and although they will require it to be made repayable on demand, they will in general practice be ready to lend for twelve months, and the loan will then be subject to repayment, renewal, or reduction. If satisfied

that the joint liability of the members of the society under its rules constitutes an adequate security for a proposed loan, the Bank will require no further guarantee for its repayment. In considering the question of security it should be borne in mind that, under the model rules for a society registered under the Friendly Societies Act, every member of the Society is, equally with every other member, jointly and severally liable for all debts incurred by the Society.

"The rate of interest to be charged on approved advances to such societies will be a favourable fixed rate, subject to a year's notice of alteration.

"It will thus be seen that the Committee of any registered Agricultural Co-operative Credit Society may apply with some confidence to the local Branch Manager of any of these Banks for advice and help in matters of book-keeping, accounts and audit, and that if they wish to obtain an advance from the Bank, and are able to satisfy the Manager and Directors that the security for repayment is sufficient, they may expect that their application for a loan will be granted on these favourable terms.

"A supplementary list of other Banks which may agree to the above arrangements will be published at a future date.

List of Banks.

Bank of Liverpool.
Barclay and Co.
Beckett and Co.
Capital and Counties Bank.
Fox, Fowler and Co., Wellington, Somerset.
Lincoln and Lindsey Banking Co.
Lloyd's Bank.
London County and Westminster Bank.
London and Provincial Bank.
London and South-Western Bank.
Manchester and Liverpool District Banking Co.
Metropolitan Bank of England and Wales, Birmingham.
National Provincial Bank of England.
Nottingham and Notts Banking Co.

Parr's Bank.
Union Bank of Manchester.
United Counties Bank.
Union of London and Smith's Bank.
Williams Deacon's Bank.
Wilts and Dorset Banking Co."

As some misapprehension has arisen regarding the scope of the arrangement above described, it seems advisable to explain its effect more fully. Several schemes have recently been suggested for providing the agriculturists of the country, and especially the small holders and allotment holders, with the capital necessary to enable them to carry on their agricultural operations. Most of these schemes depend for their success on a grant of State funds or a guarantee of State support to some central institution, to be formed with the object of making loans to individuals through Co-operative Credit Societies. The dangers attaching to State aid of this kind are obvious, and before embarking on any such enterprise it was thought best to see what could be done to obtain the necessary advances from the Commercial Banks, which are already in existence and with which the rural districts of England and Wales are exceptionally well provided. There is a general consensus of opinion that the Co-operative Credit Society is the most satisfactory means by which capital, from whatever source received, can be passed on to the small holder, who stands most in need of assistance in the matter. There are already in England and Wales forty-five such societies, based on model rules recommended by the Agricultural Organisation Society, under which the liability of each member for the debts due by the society as a whole is unlimited. The Board, therefore, approached a number of the leading Banks and asked them to state whether they could not, without departing from banking principles, offer some assistance on business terms to Co-operative Credit Societies of this character. The question was ultimately taken up by the Association of English Country Bankers, with the result that the twenty banks named in the announcement gave their consent to the arrangement therein described.

It should be noted that the assistance which these banks have agreed to give is confined to those Credit Societies which consist mainly of small holders and allotment holders, which are registered under the Friendly Societies Act, and which are based on the principle of the unlimited liability of the members for the debts of the Society. The arrangement so far made does not apply to any Society established on any other basis, or to any Society formed mainly by other persons than small holders and allotment holders. In the case of Societies to which the arrangement does apply, the Banks have agreed to allow the Manager of any of their country branches, with the permission of the Directors, to assist in the formation of a Society, to advise regarding its accounts, and to take part, when requested, in the annual audit of the Society's affairs. In small village societies the question of accounts, which is all-important in banking business, is often found a difficult one to deal with, and it will be no small advantage to a Society and its officers to have within reach a skilled banker, who will now be ready to help them with his advice in such matters without requiring any remuneration.

As regards the extent to which the banks will be prepared to provide a Society with capital, each bank naturally reserves to itself the right of requiring in each case satisfactory evidence as to the security for the loan; and, indeed, no sound banking institution, whether State-aided or not, could be expected to make an advance of money to a Society without making sure that there was a practical certainty that the advance would be repaid.

As regards the form of security to be required, the banks have agreed that the joint liability of the members of the Society may be accepted as an adequate security for a proposed loan, without any further guarantee for its repayment; subject, however, to the general condition already mentioned, that the bank is satisfied that that joint liability is in the particular case a sufficient security. It is to be expected that when a Society wishes to take advantage of this arrangement and obtain a loan from a bank without any special guarantee, the local Bank Manager and the Directors will require to be satisfied that the Society consists mainly of thrifty, industrious men, that the Committee is composed of trustworthy members of good character and credit, that the affairs of the Society are conducted in a business-like manner, that the loans to members are really expended on profitable agricultural purposes, and that these loans are punctually repaid on the due dates. Indeed, in the interests of the co-operative credit movement, and of the individual members of the Societies, it is not desirable that any institution should make advances to a Society which cannot fulfil such conditions.

As to the terms on which such advances, when approved by the Bank, will be granted to Credit Societies, the banks require that they should be made legally repayable on demand, partly as a matter of ordinary banking principle, and partly because a bank naturally wishes to have the power to recall a loan of this kind at any time, if it finds that the Society's affairs are not being conducted in a business-like manner; but they have expressed their readiness in general practice to make the loan for twelve months, and there is every reason to believe that a well-managed Society will be able to reckon with practical certainty on having the use of the money for at least a year, and will be in a position to make loans to its members for six, eight, or twelve months, according to the nature of the operations for which the loans are required, without any fear that the bank will recall its advance before the expiry of the twelve months. The Banks have also agreed that the rate of interest charged on an approved advance shall not vary with the Bank of England rate, but shall be a fixed rate subject to a year's notice of alteration. This will enable the Society to make its calculations on the basis of a fixed rate, which will be to it a much simpler arrangement than if its loan from the bank were subject to a fluctuating rate of interest. Further, the Banks have agreed that the rate they will charge shall be a favourable rate, but they are not prepared to make the rate generally public.

As already said, the arrangement made with the Banks relates only to Co-operative Credit Societies, so that if the members of any other form of Agricultural Co-operative Society wish to take advantage of it, it will be necessary for them to combine their credit by forming an entirely separate Credit Society, confining itself solely to the business of making loans to its members for profitable agricultural purposes. It does not reduce their existing facilities for borrowing money, whether from Joint Stock Banks or from other sources. All that it means is, that these banks have now expressed their willingness to give valuable assistance to Agricultural Co-operative Credit Societies on favourable terms in cases where approved security can be given.

It does not involve any legislation or any guarantee to be given by the State either to Banks or Societies, or any control to be exercised by the State over the operations of Societies, in addition to that already exercised by the Registrar of Friendly Societies. Nor does it involve any grant of State funds in support of rural credit, other than the grant already made to the Agricultural Organisation Society from the Small Holdings Account and the Development Fund, towards the organisation and inspection of Agricultural Co-operative Societies of all kinds (the amount of this grant for the current financial year has been fixed at a maximum of £9,000). Nor, on the other hand, does it preclude the formation, without State aid and under the existing law, of any new institution for furnishing capital to small agriculturists. It is based on the principle of self-help which it fosters and does not destroy.

CHICKEN REARING ON AN INTENSIVE SYSTEM.

In connection with the system of intensive chicken rearing adopted by Mr. F. G. Paynter, and described in this *Journal* for December, 1912, p. 721, it may be pointed out that the system described must still be regarded as in the experimental stage. It is most undesirable that those who have not already a thorough practical acquaintance with the management of poultry should attempt to adopt such a system, as it demands much more knowledge, skill, industry, and care than are necessary where poultry-keeping is conducted under ordinary conditions.

A general description of the equipment used in Mr. Paynter's experiment, and of the methods adopted by him, will be found in the article referred to above; but attention may be drawn to the fact that, in addition to the possession of adequate capital, and a suitable area of land in proximity to a market, a thorough practical knowledge of the best methods of artificial incubation and rearing is indispensable for anyone who proposes to attempt to carry out the system on the scale described in the article.

Those who have not the necessary knowledge are recommended either not to attempt such an experiment or to begin operations in a purely tentative way, with a view of gaining practical experience of the proper methods, and of testing their own qualifications for such an enterprise.

Success in dealing with all classes of livestock depends on certain aptitudes in the individual which are not possessed by all, and also a practical experience which can only be gained in the course of time. In addition, it must be remembered that, in all such undertakings, business capacity and the faculty for giving attention to detail are determining factors. The beginner is advised to regard intensive chicken-rearing as an occupation requiring skill and experience, without which success is unlikely to follow the adoption of any particular method, however admirable.

It would be undesirable, therefore, for the inexperienced to invest in a plant capable of raising 3,000 chickens in the season, though useful experience may be gained by attempting to raise say, one-twentieth of that number. In purchasing appliances for artificial incubation and rearing, those of the size recommended by Mr. Paynter might be used with a view to future development, but there would be no necessity to work the appliances up to their full capacity. Thus a beginner might test the suitability of the system to his individual circumstances and ability by the purchase of an incubator and one rearer, and provide, in addition, the plant necessary for 100 to 150 chickens. He must not expect the financial results of this tentative effort to produce a return proportional to that indicated as attainable under the complete system, but should regard the outlay as a necessary expenditure in training.

Such a method, if carried out systematically, would not only be the means of securing some practical experience of production, but would also give the beginner some knowledge as to local demand and prices, and methods of marketing.

As is indicated in the previous article in the *Journal,* Mr. Paynter is now conducting, under the auspices of the Board, a demonstration of his system at Haslington Hall, Crewe. For the novice who *seriously* contemplates devoting attention to intensive chicken rearing, probably the most satisfactory course to pursue would be to visit, during the spring or early summer of the present year, the demonstration which is in progress. Those who wish to pay such a visit should write *to inquire when arrangements can be made to receive them.* Mr. Paynter's time is fully occupied, and an appointment will be necessary.

BRITISH-GROWN TOBACCO.

RUPERT ELLIS.

Tobacco was first introduced into England about the middle of the sixteenth century, it being at that time chiefly valued for certain supposed medicinal qualities. The variety of leaf was probably that known as *Nicotiana Rustica,* which is still in cultivation, and which, it is of interest to note, may occasionally be found growing wild and acclimatised in certain parts of Ireland. The use of tobacco for smoking purposes was not begun until well towards the close of the century, at about which time the actual seed of the plant was imported from Virginia.

It is clear that, during the last ten years of the century and the first few years of the seventeenth, some commencement of tobacco growing in England had already been made, as in the year 1604 we find an Act passed by James I. heavily penalising the existing growers by the imposition of a duty of 6*s.* 10*d.* per lb. About the same time there was published, by authority of the King, the "Counterblaste To Tobacco," having for its object the direct discouragement of the use of the leaf for smoking purposes. In spite, however, of obstacles thus placed in the way, the use of tobacco spread gradually to nearly all parts of the kingdom, until in the year 1667, in the reign of Charles II., an Act was passed definitely prohibiting cultivation in both England and Ireland. This Act stated in its preamble that the object of the prohibition was to prevent any interference with the tobacco interests of His Majesty's subjects in Virginia.

Such, therefore, was the position of affairs at the beginning of the second half of the seventeenth century, and in this connection the comments of a well-known agriculturist of the day, John Worlidge, as expressed in his *Systema Agricul-*

turæ, published in 1697, have considerable interest, and the following extract is taken from this work:—

"I thought to have omitted this plant [tobacco], by reason the Statute-Laws are so severe against the Planters of it, but that it is a Plant so much improving land, and employing so many hands, that in time it may gain footing in the good Opinion of the Landlord, as well as the Tenant, which may prove a means to obtain some liberty for its growth here, and not to be totally excluded out of the Husbandman's Favour . . . Certain it is, that the Planting of it would employ abundance of people in Tilling, Planting, Weeding, Dressing, and Curing of it. And the improvement of Land is very great, from ten shillings per Acre to thirty or forty pound per Acre, all Charges paid: Before the last severe Laws, many Plantations were in Gloucestershire, Devonshire, Somersetshire, and Oxfordshire, to the quantity of many hundred Acres.

"Some object that our English Tobacco is not so good as the Foreign; but if it be as well respected by the Vulgar, let the more Curious take the other that's dearer. Although many are of Opinion that it's better than Foreign, having a more 'Haut-gust,' which pleaseth some; if others like it not they may in the curing of it make it milder, and by that means alter or change it as they please.

"The best way and manner of Planting and Curing it, would be easily obtained by experience: many attempting it, some would be sure to discover the right way of ordering it, and what ground it best affects.

"But that which hath been observed is That it affects a rich, deep and warm soil, well dressed in the Spring before Planting time; The Young Plants raised from seed in February or March, on a hot Bed and then planted abroad in your prepared ground, from whence you may expect a very good crop and sometimes two crops in a year. The Leaves when gathered, are first laid together in heaps for some time, and then hanged up (by threads run through them) in the shade, until they are through dry, and then put up and kept the longer the better. In this experience is the best Master." *

Matters continued in this wise until the year 1779, when, during the reign of George III., restrictions upon tobacco grown in Ireland were relaxed, subject to the condition that tobacco grown in that country should only be exported to Great Britain, and be then subject to the same import duty as that levied on American tobacco.

In the year 1830 a Select Committee, under the presidency of Sir Henry Purcell, considered the advisability of allowing the cultivation of tobacco in England; but, mainly owing to representations made by the Excise authorities as to the difficulties experienced in combating smuggling operations, it was decided not to remove the existing restrictions. In the next year followed the repeal of the Act of 1779 permitting cultivation in Ireland. The subsequent history of tobacco growing in Great Britain and Ireland has resolved itself, for the most part, into a series of spasmodic efforts to revive the industry, resulting merely in periodical permits for experimental plots.

Coming down to comparatively recent times, a considerable amount of time and trouble was devoted towards the reintroduction of the crop in the years 1886 and 1887. The figures and general information to be gathered from the record of experiments in these years cannot be said to have been of an encouraging nature as regards the future of the industry. A careful consideration of the conditions then existing, however, shows them to have been most unfavourable, and unlikely to allow of satisfactory results being obtained. Experiments were carried out in upwards of twenty counties, but no uniformity of type of seed, or method of cultivation and after treatment, appears to have been adopted, and the most diverse results are recorded.

What the experiments as a whole seem most clearly to indicate is that the practically complete failure to produce a saleable tobacco was due to an entire absence of proper drying, curing, and rehandling facilities such as are, in the light of more recent Irish experience, recognised as being indispensable for dealing with tobacco grown in the British Isles. It may here be said, moreover, that in order to carry out these operations with success, a certain amount of technical knowledge is essential, and this can, as a rule, only be gained by experience in the district where they are undertaken.

It is in this respect that the Irish experience gained during the last ten years or so will have its application in the event of the cultivation of tobacco being taken up in England.

Growers upon this side of the Irish Channel have now available, from Irish sources, a rapidly accumulating store of technical information, which ought to prove of value if ever tobacco is grown on any considerable scale in England.

Ireland having so far shown the way, and undertaken much of the pioneer work, must be held to deserve the credit of the attempt to re-introduce tobacco growing as a commercial proposition; the fact, however, that the industry has been introduced in Ireland does not necessarily mean that the Irish climate and conditions are more favourable for the crop than those of certain parts of England and Wales, and it would probably be desirable to make investigations in this direction.

The revival of tobacco-growing in Ireland was made possible by legislation, following upon a private Bill introduced in the year 1904 to repeal the Act of 1831 prohibiting cultivation in that country. Incorporated in the Finance Act of 1908 was the imposition of Excise duties on Irish-grown tobacco and upon licences to grow. These Excise duties were increased from the 30th April, 1909, to the amount of the duties upon imported tobacco, and the Finance Act of 1910 removed all restrictions upon tobacco-growing in England, Wales, and Scotland, but imposed similar duties to those applicable in Ireland.

Treasury regulations made under the above-mentioned Acts allowed to the grower one-third of the duty by way of rebate as regards Ireland, a concession that in the year 1910 was changed into a fixed grant for a number of years, to be administered by the Department of Agriculture and Technical Instruction for Ireland.

In Ireland the commercial possibilities of tobacco-growing may be considered to be already proved; and the present growers are in receipt of a subsidy for a determinate period.

The official returns of tobacco grown in Ireland and brought to charge for purposes of Excise for 1911–12 and the six preceding years are as follows:—

Year ended 31st March	1906	7,353	lb.
	1907	20,173	,,
	1908	68,612	,,
	1909	52,543	,,
	1910	59,111	,,
	1911	87.907	,,
	1912	61,881	,,

The average prices obtained in the market varied from 4*d.* to 7*d.* per lb.

With regard to England, Scotland, and Wales, restrictions upon cultivation were removed in 1911 by the provision of the Finance Act, 1910, which, *inter alia,* provided for a rebate of one-third of the duty of 3*s*. 6*d*. per lb., *i.e.*, a rebate of 1*s*. 2*d*. per lb. upon 100 acres in England and Wales and 50 acres in Scotland, to be grown during the years 1911–12–13, by growers applying to the Treasury, subject to approval by the Board of Agriculture and Fisheries and H.M. Commissioners of Customs and Excise.

In 1911 approximately 1,000 lb. of tobacco were grown and cured in Scotland, the actual amount brought to charge being 987 lb. To this should be added some 300–400 lb. grown in different parts of England, the actual amount brought to charge in this case being 319 lb.

During the year just passed a comparatively large increase in the growth of tobacco has taken place, and reckoned in acreage the following figures may be taken as approximately correct:—

Hampshire	20 acres
North Wales...	10 ,,
Norfolk	5 ,,
Scotland	5 ,,
Total	40 acres

Taking an average yield of cured tobacco at 1,100 lb. per acre, the estimated weight of the 1912 crop of Great Britain may be taken at, say, 44,000 lb., or about one-third of the probable Irish crop of the same season.

This being the first year's crop of any commercial importance, considerable interest is being evinced as to results. Certain initial difficulties will doubtless be found to have their effect upon the yield of saleable tobacco; the extremely unfavourable season will also have its bearing upon the financial aspect, so far as that may be judged from a first year's experience.

So far, the crop appears to have come through well, and the quality shown in the final process of grading and re-handling preparatory to packing, seems to be of a satisfactory order. The tobacco is still in the growers' hands, and so far but little has been sold, excepting the Welsh crop, which has been disposed of at a satisfactory figure.

EXPERIMENTAL WORK IN ARTIFICIAL INCUBATION.

W. BROWN,

West of Scotland Agricultural College.

ALL practical poultry-keepers will probably agree that the results obtained by artificial incubation are not equal to those obtained by natural means. This fact is demonstrated in two ways, namely, by the lower hatching percentage with incubators, and the higher vitality of the chickens hatched under a hen. Very little is known at the present time about the subject of artificial incubation, and it is strange, in view of the importance of the question, that so little work is being done to solve the many and complex problems that are encountered when operating incubators. For industrial poultry-keeping the whole question is of paramount importance. Once determine the conditions that are essential to the successful hatching of a large percentage of strong chickens and the whole industry will be benefited to a degree which it is difficult to over-estimate.

During the past twenty years valuable discoveries have been made in other branches of the industry, but few important improvements have been introduced in relation to incubators.

So far as is known at present there are three factors essential to success in artificial hatching, namely, temperature, ventilation, and the humidity of the atmosphere surrounding the eggs. The maintenance of an even temperature presents the least difficulty, for the majority of machines can be worked for weeks with only a very slight variation. It is, therefore, more important to consider the problems connected with ventilation and the humidity of the air in the egg chamber.

It has always been contended that pure air is necessary to the growing embryo within the shell.

During the past ten years Mr. R. J. Terry, poultry expert to the Tasmanian Government, has been carrying out experiments to test the truth of this assumption, and recently he has published the results of his work. His investigations are not by any means conclusive, but they serve to indicate the line of thought he is following. Prof. W. R. Graham, of the Ontario Agricultural College, Guelph, has also been conducting similar experiments, but they are not as yet sufficiently advanced to render publication advisable.

The contention of Mr. Terry is that both manufacturers and operators of incubators "have the mistaken idea that they are developing something which, in the embryonic state, breathes by means of lungs. If that were the case they would be quite right in their oft-repeated statement that, like a man, a chick cannot breathe too much pure air." But anyone who has given thought to the subject understands that the blood of the embryo is purified not in the lungs, but in the allantois, the respiratory sac, a membranous sheet of blood-vessels spread out beneath the shell, while the lungs are only brought into use just before the bird is hatched.

Mr. Terry was first led to investigate along his present lines after noticing the effect of free air on the blood-vessels of the embryo. He was studying the embryo with a part of the shell removed, the greater part of the egg being submerged in warm water. The removal of part of the shell had no injurious effect, but after a short exposure to the air the blood-vessels were ruptured. It was this observation that first of all suggested that eggs receive too much air in modern incubators. All operators know that in testing eggs there are a number showing an irregular broken ring of blood, instead of the "spider" seen with a living embryo. To throw further light on this subject a number of eggs were placed in different incubators of the same make which were worked under similar conditions except as regards ventilation. More ventilation was allowed to some of the machines than to others. The result was, in Mr. Terry's own words, that "Those incubators which had an excess of ventilation gave the poorest results, both as regards the ruptured system occurring some time before the sixth day, also as to a large number of dead in the shell."

We have frequently noticed this blood ring on testing for fertility on the sixth day, but whether it is formed after the death of the embryo, or is the cause of death, is a question for the embryologist to answer.

In support of his theory Mr. Terry advances one important argument which is supported by other investigators, namely, that in natural hatching there is a large amount of carbon dioxide in the air surrounding the eggs. This has been shown not only by Mr. Terry, but earlier by Prof. W. H. Day, of Guelph, Prof. J. Dryden of the Utah Station, and Mr. J. L. Nix, Homer City, Pa. The quantity is frequently known to be three times greater than that in incubators. Even when hens have been tested when sitting on dummy eggs in an indiarubber nest, the amount of carbon dioxide in the air has been found to be considerably greater than in a well-ventilated machine. This appears to indicate that the carbon dioxide is given off by the hen's body, and is not the accumulation of gas given off by the eggs. This is the most important fact that has been brought forward in favour of the theory that carbon dioxide is beneficial to the developing embryo.

The Sydney *Daily Telegraph* gave prominence to the theory advanced by Mr. Terry, and to assist in the investigation they instructed Mr. S. Ellis, of Botany, New South Wales, to conduct a series of experiments, which would, to some extent, check the conclusions. Mr. Ellis was somewhat opposed to the idea, but carried out two experiments. The two tests were so closely alike that it will be sufficient to quote the last one as extracted from the journal named:—

"The second incubation test conducted by Mr. S. Ellis, of Botany, New South Wales, confirms the results of the first experiment. His eight Zenith machines were run on exactly the same lines as in the first test as regards ventilation and moisture, and the eggs were from the same pen of White Leghorns. In this instance a variation was made in regard to the system of turning the eggs in the incubators. There was a striking similarity between the results of the respective machines in the two hatches, and again the highest percentage and the best chickens were produced with no ventilation for the first fourteen days. The general average of living chickens from the eight hatches was 68·4 per cent., as compared with 71·4 per cent. in the first test. Of course, in considering these averages, it has to be borne in mind that some of the incubators were run for experimental purposes under conditions that were not expected to give first-class results.

Mr. Ellis reports of the individual hatches as follows:—

"No. 1 incubator.—Water from the start; normal top and bottom ventilation; eggs turned three times a day, with plenty of airing, but nevertheless proved to be too wet.

"No. 2.—No ventilation until the fourteenth day, then opened right out as usual; no water; eggs turned three times a day, with plenty of airing. These were extra good chickens —could not have been better.

"No. 3.—Only ½ inch top ventilation hole on side until fourteenth day, then two holes in each end as large as a lead-pencil; no water; eggs turned three times a day from the first twelve hours until the seventeenth day, then no more. The chickens were all that could be desired, being good and strong.

"No. 4.—No ventilation under the eggs, but two 1-inch holes over the eggs, one each side; no water; eggs first turned on the third day, and once per day on alternate days thereafter. The chickens were rather weakly, seven of them being cripples.

"No. 5.—Only one ventilation hole in the bottom under the eggs; no water; eggs turned after the first twelve hours every second day until the seventeenth day, and not after. A few of the chickens were good, but the others were not of much account; nine were very miserable things, not worth keeping.

"No. 6.—Half-ventilation holes, one at side and one at end, for first fourteen days, then opened right out; no water; eggs turned twice a day. There were very good chickens, but not enough of them.

"The machines which had no water (Nos. 2, 3, 4, 5, 7, and 8) were provided with wet scrim in the drawers when starting to chip. No. 2 machine had so much moisture about it that the drops of water gathered on the inner glass door. In my opinion turning the eggs twice a day is best."

It is difficult to reconcile this evidence with the results obtained from tests conducted at the University College Poultry Farm, Reading, unless climatic conditions have a greater influence on artificial incubation than is believed. The particulars published in this *Journal*, June, 1904, p. 135, May, 1905, p. 87, and July, 1906, p. 201, showed most clearly that the best results in hatching were obtained from those machines which were only partially filled with eggs, and the conclusion arrived at was that this increase in the hatching percentage was due to the increased air supply. The 1904 Report states: "It is suggestive that in this connection all the highest percentages were obtained by machines in which, after testing, the removal of the non-fertile eggs reduced the number remaining much below the capacity of the egg chamber, indicating that overcrowding is undesirable." Again, in the 1905 Report, reference is made to the same point. "An examination of Table II. again suggests what was a very striking fact in the previous report, namely, that the highest averages were obtained by machines which, after taking out the infertiles on the seventh day, were only partially filled. These observations apply to all the different types of incubators."

So little is really known on this subject, and the experiments have been so few, that no conclusions can be drawn from the results. The subject is so important that no theory should be allowed to remain untried.

One feature of the case must not be forgotten, namely, the chemical effect of carbon dioxide on the shell of the egg. The chemical action of carbon dioxide, in conjunction with moisture, is to decompose the shell, and it is certainly true that this renders the exit of the chickens more easy of accomplishment. Mr. Terry gives it as his opinion that the bulk of the chickens found dead in the shell die of exhaustion. He has examined large numbers, and he states that "in nearly all cases they showed that the birds had been striking at the shell, while in several instances their vigour and sustained effort had resulted in extravasated blood around the head, especially base of beak and upper portion of the neck. This was most noticeable in those incubators which did not contain any water supply; but in one of the same machines, containing the same class of eggs, and located in a cellar, the result was altogether different, there being practically no dead in the shell."

If carbon dioxide is an essential factor in incubation then it may be suggested that this gas should be supplied, and not obtained by lack of ventilation.

Prof. Graham is experimenting in this direction. By means of alcohol burners he is adding carbon dioxide to the air in the egg drawer, but the great difficulty with which he has to contend is that no burner has yet been introduced that will burn with sufficient steadiness to generate a constant supply of carbon dioxide. Until such a burner has been invented it will be impossible to work with that exactitude which is essential for scientific purposes. This line of thought does not monopolise all Prof. Graham's attention. There are a number of poultry-keepers who hold the belief that the oil which is secreted from the body of a broody hen, and which covers the shell of the egg in the nest, has a beneficial effect on the growing embryo. This theory is held by many of the most scientific Belgian breeders, as well as by those in other countries, and Prof. Graham has set himself to endeavour to test the truth of the statement.

Experimental work in incubation is but just beginning. The problems to be solved are almost numberless, and it will only be by slow and patient work that the final result can be achieved, namely, to render artificial incubation as successful as natural hatching.

THE APHIDES ON MANGOLDS AND ALLIED PLANTS.*

FRED. V. THEOBALD, M.A., F.E.S.

Professor of Agricultural Zoology (London University) and Vice-Principal, South-Eastern Agricultural College, Wye.

THE BOAT GALL OR THE GREEN MANGOLD APHIS †
(*Aphis atriplicis*, LINNAEUS).

General Description and Life History.

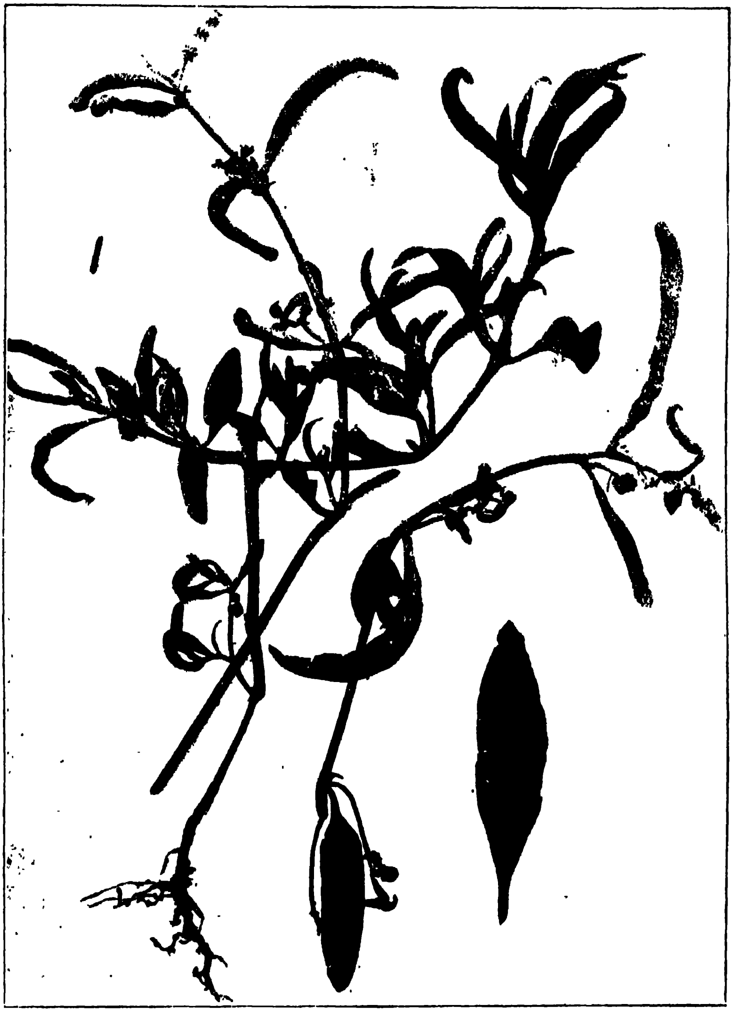
Linnaeus's *Aphis atriplicis* is quite distinct from the viviparous forms described by Buckton, which were *rumicis*. It is a green Aphis and a marked "gall"-former, producing boat-shaped galls on the leaves of cultivated and wild Chenopodiaceæ, including Beta, Chenopodium, and Atriplex.

The Aphides affect the upper sides of the leaves, and mainly settle on the mid-rib. Hayhurst (22) says also that they settle on the main veins of the leaves in America. I have not seen them do so in England; only the mid-rib seems to be attacked in this country. The result of their numerous punctures is to produce the very marked appearance

---

* Concluded from *Journal*, September, 1912, p. 466.

† *Aphis atriplicis*, Linnæus (Fauna Suecica, 1000); *Aphis chenopodii*, Kaltenbach (Mono. der Fam. der Pflanzenlause, p. 107, 1843); *Aphis chenopodii*, Schrank (Fn. Boica. II. 109, 1196); *Aphis chenopodii*, Cowen (Bull. 31, Colorado Exp. Sta.); *Aphis atriplicis*, Buckton (part) (Mono. Brit. Aphides, II.); *Hayhurstia atriplicis*, Del Guercio (this genus has not been generally adopted).



GALLED LEAVES OF ATRIPLEX CAUSED BY *Aphis atriplicis*.

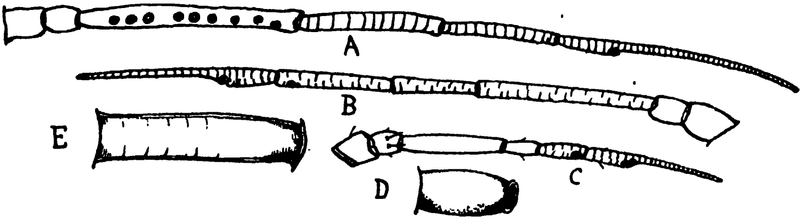
seen in the photograph reproduced here of a colony on *Atriplex portulacoides*. Exactly the same appearance occurs on the mangold, beet, and sugar beet. I have, however, seen it only once on the beet, and twice on sugar beets in this country to any injurious extent. The effect of the insects' punctures is to cause the leaves to curl upwards and eventually to enclose the insects entirely. I was never able to obtain any winged females either on mangold or beet, or on Atriplex, although in September I found two nymphs on Atriplex, and many on mangolds. I therefore quote from Hayhurst as follows: "During the first week in August, 1908, the winged viviparæ were leaving the galls in great numbers, a general migration being apparently at its height. After the middle of August, pupæ were not common in the galls, which were almost deserted, except for a few wingless viviparæ and larvæ."

Connold observed a similar migration in August in England. In September, Hayhurst noticed sexed forms, and found that most of the females had left the galls, and were on the seed heads, and they oviposited there. In this way, connected with the seed, the Aphides get distributed, and hatch out on the young plant soon after the seed has germinated.

The *ova* are at first yellow, then deep green, and finally black: they are placed on the calyces and seed capsules, and on the small leaves of the upper branches, and a few in the galls. It is thought that it was through the introduction of the white goosefoot (*Chenopodium album*) into America that this Aphis made its way to that continent.

Description of *Aphis atriplicis*, Linnæus.

Winged Female.—Green, head dusky, antennæ dusky, sensoria on the third segment varying from 9–13; eyes red. Pronotum, dusky green; mesothorax, greenish yellow; prescutum, scutal lobes, and postscutellum, blackish; scutellum, brownish with black margins. Base of femora brownish yellow, rest dusky; tibiæ, brownish yellow with dusky apex; tarsi, dark. Abdomen, green to yellowish green. Dorsum with irregular, variable maculations; four large lateral spots, distinct and dark, in front of cornicles.



APHIS ATRIPLICIS Linnæus.

A. *Antenna of alate female.* B. *Antenna of apterous female.* C. *Antenna of larva.* D. *Cornicle of larva.* E. *Cornicle of wingless female.* (All mag.)

Cornicles dusky, very slightly swollen at and beyond the middle, smooth. Cauda, pale yellowish, margin anterior to the distinct median constriction black, posterior to which are three pairs of long curved setæ; anal plate with similar setæ, 6–8 along the posterior margin.

Length.—1·49 mm.

Nymph.—Uniform in colour, except for irregular darker green areas on the thorax, and dusky wing tips.

Wingless Female.—Greenish; head, dusky yellowish green with two darker spots. Eyes, deep red to almost black. Thorax either uniformly green or with some darker markings. Abdomen, same colour as thorax, uniform save for four or five dusky lateral spots. Cornicles, pale yellowish green with dusky apices.

A mealy coat all over the thorax and abdomen.

Length.—1·50 to 1·57.

Oviparous Female.—Green; eyes black to red. Cornicles dusky; cauda, pale yellow or dusky. Legs dusky, except paler base of femora; hind tibiæ dusky, swollen, with 30 to 40 sensoria above and below.

Length.—1·45 mm.

Wingless Male.—Eyes dark red. Pronotum dusky. Mesothoracic lobes brownish. Abdomen dusky yellow, dorsum with irregular, dusky marks. Lateral tubercles more pronounced than in the female. Cornicles dusky. Cauda dusky.

Length.—1 mm.

Food Plants.

Chenopodium album, C. murale, C. urbicum, C. quinosa, C. hybridum, C. vulvaria, C. polyspermum; Atriplex portulacoides, A. patula, A. littoralis, A. angustifolia, A. latifolia, A. hortense, A. babingtoni, and *A. hastatum* (Houard). Cultivated beet, sugar beet, and mangolds.

British Localities.

Wye, Herne Bay, Seasalter, Faversham, Romney Marsh in Kent; Hastings and neighbourhood (Connold); Guernsey (Luff); Cambridge (F.V.T.).

Foreign Distribution.

Sweden, Germany, Hungary, Italy, Belgium, and the following places in America: Nebraska, Illinois; Fredonia, N. York, and also Lily Dale, Jamestown, and Chautauqua, N.Y.; Missouri, Kansas, Colorado; Portland, Michigan; Geneva, New York City, Washington; Corvallis, Hood River, Ore.; Fort Collins (Gillette). Gillette (*Journ. Eco. Ent., III.*, 405, 1910) describes it as a very abundant species, generally distributed in Colorado upon both sides of the mountains, and up to fully 7,000 feet altitude.

REFERENCES.

1. *Linnæus, C. von.*
Faun. Suec. 1000 (1746).
2. *Schrank, F. d. P.*
Faun. Boic. II. 109. 1196 (*chenopodii*) (1799).
3. *Walker, F.*
List. Homopt. IV. 982 (1852) (*atriplicis* and *chenopodii*).
4. *Kaltenbach, J. H.*
Mono. Pflanz. 107–108 (*chenopodii*) (1843); Pflanzenfeinde, 505. 508 (*chenopodii* and *atriplicis*) (1874).
5. *Lichtenstein, J.*
Les Pucerons. La Flore d. Aphid. 80. 85 (1884).
6. *Oestlund, O. W.*
Ann. Rep. Geo. and N. Hist. Surv. Minnesota, 14. p. 47 (1886).
7. *Passerini, G.*
Gli Afidi. 31 (1860).

8. *Buckton, G. B.*
Mono. Brit. Aph. II. 87 (1879) (*rumicis* and *atriplicis*).

9. *Bruner, L.*
Bull. 23. U.S.A. Dep. Agri. (Div. Ent.) (O.S.), 17 (1891).

10. *Williams, T. A.*
Univ. Nebraska. Dep. Ent. Spec. Bull. I. 6. 10. 12. 20. (1891).

11. *Del Guercio, G.*
Nuov. Relazioni. R. Staz. Ent. Agrar. 1. 2°. 2. 124. 132 (1900).

12. *Forbes, S. A.*
Bull. 60. Ill. Agri. Exp. Sta. 430 (1900).

13. *Hunter, W. D.*
Bull. 60. Iowa. Agri. Exp. Sta. 63 (1901).

14. *Connold, E. T.*
Brit. Veg. Galls. 233, 234. pl. 101 (1902).

15. *Bignell, G. C.*
Ann. Rep. 72. Roy. Cornwall Polytech. Soc. 24 (1904).

16. *Luff, W. A.*
Guernsey. Soc. Nat. Sc. Rep. and Trans. 88 (1905).

17. *Schouteden, H.*
Aphid. Belg. Mém. Soc. Ent. Belg. 12. 216 (1906).

18. *Sanborn, C. E.*
Kansas Univ. Sci. Bull. III. 8. 232. 235. 248. 254. 255 (1906).

19. *Hayhurst, P.*
Anns. Ent. Soc. Ann. II. 11 (1909).

20. *Gillette, C. P.*
Journ. Eco. Ent. III. 405 (1910).

21. *Cowen.*
Bull. 31. Colorado. Exp. Sta.

22. *Theobald, F. V.*
The Entomologist, xliv., Dec. 1911; Rep. Eco. Zool. year ending Sept. 30, 1911, pp. 75–80 (1912).

23. *Ross, H.*
Die Pflanzengallen Mittel- und Nordeuropas, 1911.

24. *Grevillius, A. Y., and Niessen, J.*
Zoocecidia et Cecidozoa imprimis provinciæ Rhenanæ. Arbeiten des Rheinischen Bauern-Vereins. Fasc. II. No. 34 (1907).

25. *Rostrup, S.*
Danske Zoocecidien. Nat. hist. Medd. p. 29. No. 180. Copenhagen (1896).

26. *Martel, V.*
Les. Cécides des environs d'Elbeuf. Bull. Soc. étud. Sci. Nat. Elbeuf. t. 10. p. 13. No. 10 (1891).

27. *Loiselle, A.*
Les Cécidies des environs de Lisieux. Bull. Soc. Hortic. Bot. Centre Normandie. Ext. p. 2. Lisieux.

28. *Kieffer, J. J.*
Synopsis des Zoocécidies d'Europe, Ann. Soc. Ent. Fr. t. 70. p. 266 (1901).

29. *Marchal, C., and Chateau, E.*
Catalogue des Zoocécidies de Saône-et-Loire, Mém. Soc. Hist. Nat. Autun. t. 18. p. 242 (1905).

30. *Trotter, A., and Cecconi, G.*
Cecidotheca Italica, Fasc. V. No. 106 (1902).

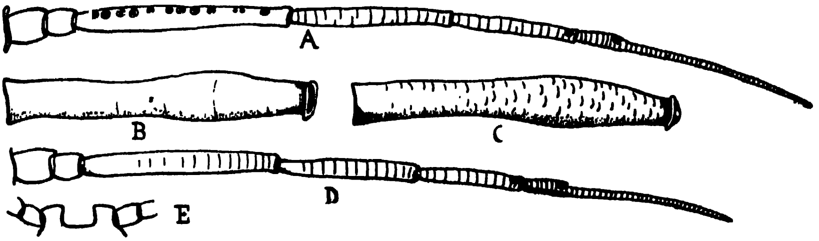
31. *Corti, A.*
Contribution à l'étude de la Cecidologie Suisse, Bull. Boissier (2). T. 4. No. 18. p. 7 (1904).

32. *Geisenheyer, L.*
Ueber einige neue und seltenere Zoocecidien aus dem Nahegebiete, Zs. Ent. Neudamm. p. 34. No. 37 (1902).

33. *Stefani-Perez, T. de.*
Micellanea Cecidologica, p. 129–130. Avellino (1906).
34. *Mariani, G.*
Secondo contributo allo Studio della Cecidologia Valdostana, Alti. Soc. Ital. Sci. Nat. p. 297. No. 78 (1907).
35. *Rüebsaamen, E. H.*
Die Gallmuecken und Gallen des Siegerlandes, Verh. Nahist. Ver. p. 34. No. 37 (1890).
36. *Schlechtendal, D. H. R. von.*
Die Gallbildungen (Zooceciden) der deutschen gefaesspflanzen, Jahresber. ver. Natk. p. 45. No. 390. p. 44 (1890).
37. *Houard, C.*
Sur quelques Zoocécidies de l'Asie-Mineure et du Caucase. Marcellia, Padora. T. I. p. 50–53. 5 fig. (1902); Les Zoocécidies des Plantes d'Europe et du Bassin de la Mediterranée (1908 and 1909).

THE ALLIED GREEN MANGOLD APHIS (*Rhopalosiphum betæ*, nov. sp.).

This is quite a common green Aphis found on beets, mangolds and some wild Chenopodiaceæ. I originally took it to be Schrank's *Aphis chenopodii.* Both Kaltenbach and Schouteden in recent years, however, place Schrank's species as a synonym of Linnaeus' *atriplicis.* I am forced, after comparing the descriptions, to do the same, and hence the Green Aphis, so abundant on beets and mangolds in 1911, must be described as a new species. This deep and bright green louse nearly always occurred with *Aphis rumicis.* On only two occasions did I find isolated colonies; one at Wye, where they had collected under the beet leaves in my garden, and the other at Faversham on mangolds.



RHOPALOSIPHUM BETAE, nov. sp.

A. *Antenna of alate female.* B. *Cornicle of alate female.* C. *Cornicle of apterous female.* D. *Antenna of apterous female.* E. *Head of apterous female.* (All mag.)

The isolated colonies caused the leaves to curl and crinkle up much as in the case of the Black Aphis. As a rule only three or four occurred on a leaf with *rumicis,* but now and again I found the two species in equal proportions. Scarcely any alate females were found in 1911. Considerable numbers were sent me from Bromley, in Kent, and from Herne Bay, and in all fields I examined in 1911 I found it present, but never in such profusion as *Aphis rumicis* and *A. atriplicis.*

In July, 1912, I also found this species in abundance in the gardens of Reading College on ornamental beets. Winged and wingless forms occurred side by side with *Aphis rumicis.*

Description of *Rhopalosiphum betæ,* nov. sp.

Apterous Viviparous Female.—Green of various shades, some pale, others of a deeper hue; apex of cornicles and the feet dusky. Eyes blackish red. Apices of antennæ dusky. Cauda green.

Antennæ with a small nail on the basal segment, the third segment longer than the fourth, the fourth longer than the fifth, the fifth with a single sub-apical sensorium, third to sixth segments imbricated. The cornicles slightly swelling on the apical half, and imbricated.

Cauda with three pairs of lateral chætæ.

Length.—1·5 mm.

Nymph.—Very similar to the apterous female. Wing buds green. The third segment of the antennæ does not show imbrication. Cauda green and broad with apparently only a single pair of chætæ.

Alate Viviparous Female.—Thorax black; abdomen green with black transverse bars and black lateral spots. Legs and antennæ green, semi-transparent. Antennæ with the third segment with eight to nine large and three to five small sensoria, fourth, fifth, and sixth segments imbricated. Cornicles simple and with a few markings, but not true imbrication.

Cauda long with three pairs of lateral chætæ and a submedian pair near the apex.

Length.—2 mm.

Habitat.—Herne Bay, 4.7.11, winged and wingless females (mangolds); Wye, 2 to 14.7.11 (beets), wingless females only; Faversham, 4.7.11, and Dover, 4.7.11, on mangolds; Bromley, 2.7.11, on mangolds; also in various other parts of Thanet; Reading, 10.7.12.

THE SHORT-SIPHONED MANGOLD APHIS (*Aphis brevisiphona,* nov. sp.).

Specimens of this aphis were found with *Aphis rumicis* and *Rhopalosiphum betæ.* Unfortunately, no notes were made of them when fresh. The marked characters seen, however, in balsam preparations at once show it to be a distinct species.

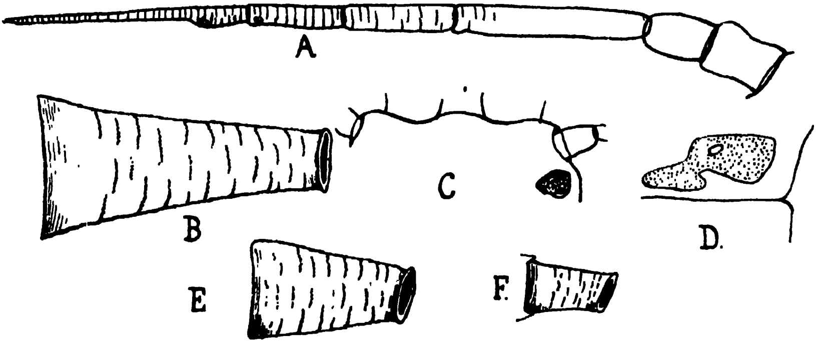
Apterous Viviparous Female.—General colour very dark green to almost black. Tips of antennæ dark; cornicles short and dark. Cauda dark. Antennæ much shorter than the body, the third segment longer than the fourth, the fourth a little longer than the fifth with a single sub-apical sensorium; the third segment shows slight, the remainder prominent, imbrication. The cornicles are short and thick, much expanded at the base, with marked zigzag imbrications across them.

The cauda with numerous curved hairs much as in *rumicis.* The body with many dark granular areas. The cauda longer than the

cornicles. Tarsal segments markedly imbricated; tip of ungues pale. Femora and tibiæ hairy, especially the hind tibiæ.

The young females show similar characters, but the cauda is short and broad, and the cornicles and the antennæ are shorter.

The larvæ have similar characters, but the antennæ are shorter still, and the legs and cornicles broader. They are about the same size as *R. betæ.*



APHIS BREVISIPHONA, nov. sp.

A. *Antenna of apterous female.* B. *Cornicle.* C. *Head.* D. *A granular area of body.* E. *Cornicle of young female.* F. *Cornicle of larva.* (All mag.)

Food Plants.—The specimens were found with ***Rhopalosiphum betæ*** and with ***Aphis rumicis***, on a wild Chenopodium, not identified, and also on mangolds.

Locality.—Herne Bay, 4.7.11. I at first took this species to be *Aphis ochropus* of Koch, but the cauda is longer than the cornicles, and the cornicles are not straight, and almost cylindrical, as they are in *ochropus*.

THE TEASEL APHIS (*Aphis ochropus*, Koch).

This Aphis was described by Koch * from the Teasel (*Dipsacus sylvestris*) and Chenopodium, and also by Kaltenbach † as found in the months of June and July.

I have taken this Aphis once only on docks, and never on Chenopodiaceæ. It can be distinguished from *Aphis brevisiphona* from the fact that the dark cornicles are longer than the cauda, and are straight and nearly cylindrical, and not swollen basally as in *brevisiphona*.

The winged female has a black head, thorax, and antennæ, and black cornicles; the body is olive-coloured, with darker stripes and lateral spots; the legs are orange yellow with black femora and dusky tarsi.

The wingless female is olive green with yellowish-white legs, tips of the femora and tarsi dark; cornicles and cauda black; antennæ yellowish-white with black basal segments. There are some dark areas

---

* *Die Pflanzenläuse Aphiden*, 128, 1857.

† *Die Pflanzenfeinde aus der Classe der Insecten*, 505, 1874.

on the thorax, and the abdomen has pale lateral lines and bands near the apex.

The only specimens I have found in Britain were a single dense colony of winged and wingless females and nymphs, taken on Rumex on Wye Downs on July 30th, 1911.

REMEDIES FOR AND PREVENTION OF MANGOLD, BEAN AND BEET APHIS.

Owing to the enquiries made in 1911 concerning the treatment of the Aphis blight on roots, some experiments were carried out on a small scale with regard to spraying the attacked roots.

Nicotine wash, being expensive, was quite out of the question, so trials were made with soft soap and quassia and paraffin jelly.

As the Black Aphis settles mainly on the under surface of the mangold leaves it was not considered that much good was likely to result from the treatment. Very many Aphides, however, were in the young centres of the plants, and it was found that these were easily destroyed and the more delicate parts of the plants cleaned, this being of considerable advantage.

It was also noticed that when the wash was sent down with considerable force a large quantity rebounded on to the under sides of the leaves, so that in many instances the plants were quite cleared of the dolphin, and in all cases the insects were so far reduced in number that the sprayed beets soon grew away from those in the untreated rows.

Soft soap and quassia proved quite as beneficial as paraffin jelly. It is quite worth while to spray badly attacked mangolds with a potato sprayer, using a copious supply of a cheap aphicide. There are several of these on the market and I find that nearly all are effective.

The quantities of soft soap and quassia used were: soap 8 lb. and quassia 5 lb. to every 100 gallons of water.

Spraying for the attack of "Collier," or Black Fly (the same insect) on broad beans in the garden is certainly advisable when the insect has been allowed to spread downwards. It may also be done successfully in the field with knapsack sprayers. Mr. Green (*vide* Report for the year ending April 1st, 1907, p. 107, F.V.T.) tried this method and so saved the crop.

To prevent infestation of mangolds, the primary host plants, especially wild poppies, must be destroyed. Of course, this can be done on cultivated land, but it seems quite hopeless to attempt such a thing on the many wild places along the coastland and on waste hillsides where poppies flourish. It is a point to be aimed at, however, and cannot but tend to lessen the chances of these periodical black blights, not only on mangolds but on other plants.

The fact that this Aphis winters on the spindle tree (*Euonymus*), both in Europe and America, is also worth noticing. It is certainly advisable to destroy all such in hedgerows and in woodlands when being trimmed or cut down. Even then docks (*Rumex*) must be dealt with, for the Aphides winter on those plants also in the egg stage, and all that can be done to lessen the number of docks is of course desirable.

On broad beans *Aphis rumicis* always attacks the tops first, and the attacked tops should be nipped off as soon as any colony is seen, together with the sound tops, for the young lice produced by the winged females do not seem to be able to flourish on anything but the tender top growths.

Bingley, in 1820, recommended this treatment for the garden, and also gave this very wise advice: "It would, perhaps, on some occasions, be found economical for the farmers of a district to contribute amongst themselves so as to pay the damage that would arise to any particular person for having the whole crop of a field, in which they first began, destroyed at once, in order to prevent the insects from spreading further and thus injuring the adjacent crops." This is sound advice as regards Aphides which settle on beans, for these do not seem to be willing to settle for a time on other plants. At least, I have been unable to get them by artificial transmission to do so, except in one doubtful case. They will reproduce at once when put on other bean plants. When beans get so damaged that winged broods appear, the winged viviparous females fly to other beans. The great blights coming from the spindle to the poppies produce a race that will not only attack the bean and the mangold, but the many other plants recorded here; those from *Rumex*, on the other hand, do not seem to pass further than the broad bean.

THE PRODUCTION OF CLEAN MILK ON TWO LARGE DAIRY FARMS.

"HOME COUNTIES."

The Kelmscott herd of pure-bred dairy shorthorns is said to be the largest in the country, and the system on which it is kept is an example of the steps taken on good dairy farms to ensure the healthiness of the stock and the purity of the milk. The owners, Messrs. R. W. Hobbs and Son, send milk to London daily from more than 200 cows, and farm an area of 2,144 acres in contiguous holdings in Oxfordshire, Gloucestershire, and Wiltshire, on a considerable variety of soil.

Measures taken to Ensure the Cleanliness of the Milk.—In 1909 all cows and heifers in milk were tested for tuberculosis, and since that year the stock has been tested annually. So far, only eight animals have reacted, and six of these were stock not bred at Kelmscott. No cow that reacts is allowed to contribute to the milk supply. In 1911 a valuable cow that had reacted was sent to the knacker, and post-mortem examination fully justified the destruction of this animal.

Careful milk records have been kept for many years, and every cow's milk is weighed daily. The milkers have clean smocks twice a week, the smocks being provided and the washing done by the firm. The men are required to wash their hands before and after each milking, and it is proposed to provide them with paper or washable caps. During most of the year the cows are groomed before milking, and the udders are washed. The tails, udders and hindquarters are kept clipped. The Dutch system of tying up the cows' tails has been considered, but as the gutters behind the animals are cleaned twice a day, it has not been thought necessary to introduce it. The buildings to which the milk is taken are cut off from the cow-houses, so that cattle do not pass them, and there is very little other traffic. The milk is not pasteurised, but is simply cooled. On the day I visited the cooling house the milk was 92° F. on entering the cooling apparatus, and 58° F. on coming out into the railway churns. Between the cow and the churn the milk is filtered four times.

Although there are a dozen milking machines in use within a radius of ten miles of Kelmscott, they have not yet been adopted here, as it is felt that the trouble of keeping milking machines clean, the risk of cups falling from teats, and the danger of blood passing with the milk owing to a temporary ailment of a cow, are arguments of some weight against machines, especially when no great difficulty has been experienced in obtaining a sufficient supply of men to milk.

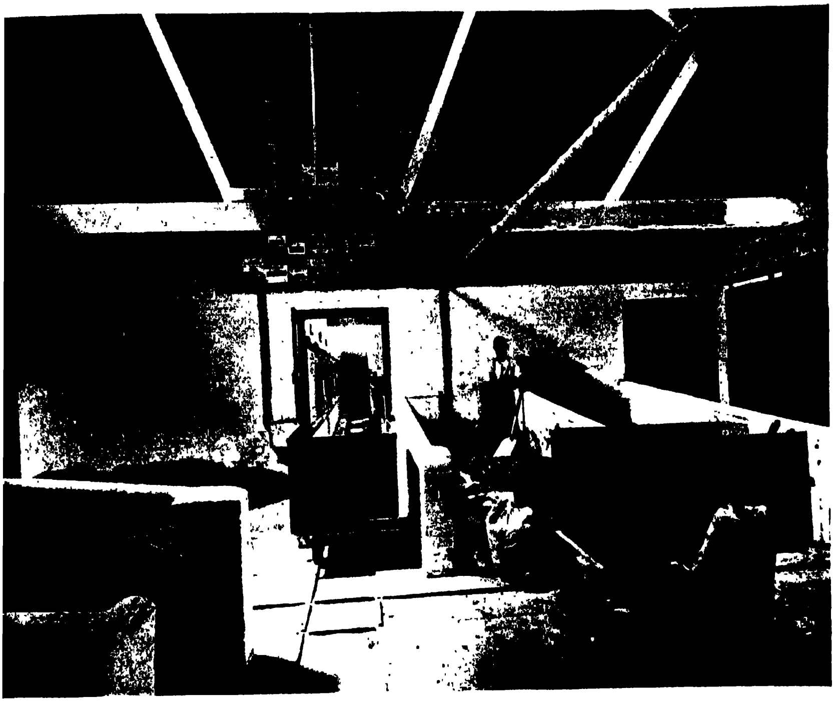
The cow-houses are all particularly airy, and some of the old houses are open in front.

Last year a good deal of peat moss litter was used. The peat litter has cost 33*s.* 1*d.* per ton delivered. A ton goes as far as 3 tons of straw. Wheat straw has cost about 50*s.*, while sawdust, the supply of which is insufficient, has cost 15*s.* per ton. As far as possible, straw is fed to stock instead of being used as litter. The straw is chaffed by the motive power used for the threshing, and is carried away in specially boxed carts. As much manure as practicable is made under cover, and when possible above a good depth of road dirt. Liquid manure is saved whenever possible.

Wages.—The average wages of an Oxfordshire labourer are estimated at 13*s.*, or, with harvest money, cottage if provided, extras, &c., 16*s.* 4*d.* Messrs. Hobbs' books showed the wages of a day-labourer from October 1st to September 30th to be 15*s.* 4*d.*, without cottage; of an under-carter to be 17*s.* 0½*d.*, including 52 weeks' lodging at 1*s.* a week; of a head shepherd, 26*s.* 2*d.*, reckoning 1*s.* 6*d.* a week for cottage and garden. The firm is well satisfied with the class of labour it obtains. The men's cottages are of an exceptionally good class, the social life of the village is animated, and the migration is small.

Staff.—The staff consists of a foreman at one of the farms, studsman, herdsman, blacksmith, 3 carpenters, 7 shepherds, 24 milkers and cattlemen, 5 lads to clean cows and cool and weigh milk, 12 carters and under-carters, 15 lads and boys with the horses, 6 day-labourers who work with the threshing machine or clover huller through the winter, about 22 day-labourers, and 4 grooms and gardeners who help in haymaking and harvest. Total 102.

Feeding.—The rations fed to the cows vary greatly accord-



IG. 1.—NEW STYLE COW HOUSE AT KELMSCOTT, SHOWING MIXING BAY AND FOOD WAGGONS ON RAILS.

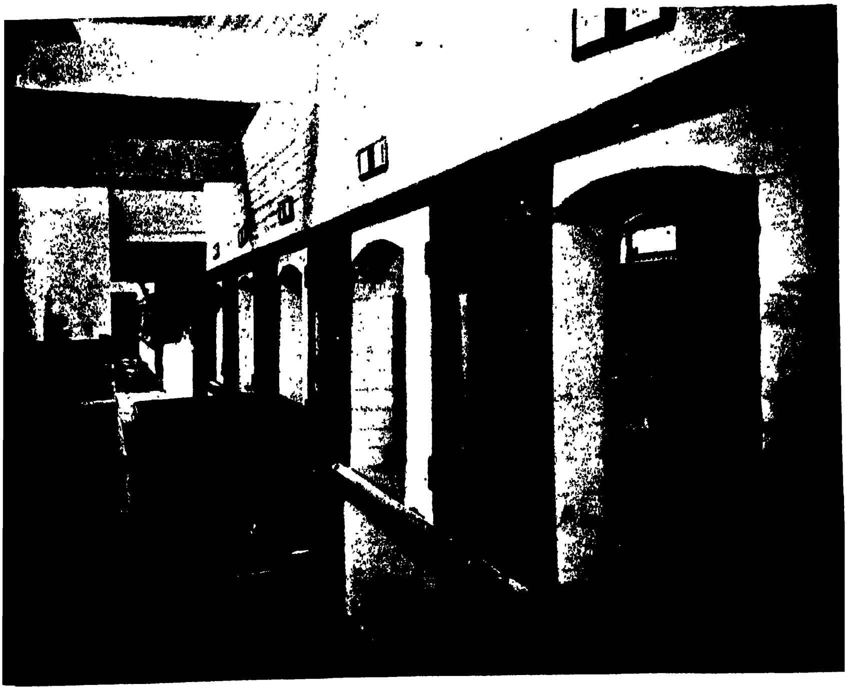


FIG. 2.—THE NEW COWSHEDS AT KELMSCOTT.

ing to the value of the different feeding stuffs, but the following tables indicate average feed :—

Winter.	*Summer.*
3 lb. dried grains.	2 lb. cotton cake.
3 lb. mixed beanmeal and oatmeal.	1 lb. soya bean cake.
3 lb. cotton, soya bean, and dairy cake, mixed.	1 lb. dairy cake.
9 lb. per day for thirty weeks.	4 lb. per day so long as the animal gives 2 gals. daily.

Average Milk Yield.—The average milk yield per cow per year for the three years ending September 30th, 1911, was for 134 cows, 6,015 lb., this being the lowest average for many years owing to the summer drought. The average yield per cow for 1910 was 6,330 lb. (10¼ lb. to the gallon), and for 1909 6,500 lb. The average yield of an average farm cow in Great Britain is, perhaps, 4,500 lb. During the past three years there have been on an average fifteen cows milking at Kelmscott yielding about 1,000 gallons or over. Rose 26th yielded 13,903 lb. from June 10th, 1904, to June 10th, 1905. At Tring Show she gave 72½ lb. 6 oz. in 24 hours. Blossom 5th, between December 28th, 1898, and September 2nd, 1908, produced 10 calves. Her average annual yield for ten years was 8,049 lb., and her total yield 86,523 lb. The herd has been bred for milk since 1878, and cows and heifer calves are rarely purchased.

Expenditure.—Taking an average of recent years, the following expenditure has been incurred in a twelvemonth :—

	£	s.	d.
Horses	746	19	4
Cattle	312	15	2
Sheep	171	16	2
Pigs	7	12	0
Seedcorn and seeds	413	5	2
Feeding stuffs	4,168	8	10
Rates	167	7	2
Rent	1,975	10	9
Bills	1,183	19	2
Labour	3,782	11	5
Hay and straw	30	7	11
Manures	135	13	9
Total expenditure ...	£13,096	6	10

Estimated Cost of a Herd of 40 *Cows.*—Messrs. Hobbs have made the following estimate of the cost of a herd of 40 dairy cows kept on their system. It may be noted that they won the Oxfordshire and the Bath and West Agricultural Societies' prizes for the best herd of dairy cows.

ESTIMATED COST OF HERD OF 40 DAIRY COWS.

		£	s.	d.
Grazing 1¼ acres per cow = 50 acres at 30/-		75	0	0
Rates at 2/6 in £		9	7	6
After feed 1¼ acres per cow = 50 acres at 6/-		15	0	0
1¼ tons hay = 50 tons at 40/-		100	0	0
56 lb. mangolds per day per cow for 210 days = 5¼ tons × 40 = 210 tons at 5/-		52	10	0
6d. per cow per day Feeding Stuffs, 210 days =	£5 5 0			
2½*d.* „ „ „ 90 „ =	0 18 9			
	£6 3 9 × 40 =	£247	10	0

Attendance 40 Cows.

Thirty Weeks' Winter.

		£	s.	d.
2 men to milk and feed, &c., at 16/- per week =	1 12 0			
2 „ milk (only) at 7/- „ „ =	14 0			
1 lad to wash and clean cows 5/4 (part time) =	0 5 4			
1 „ carry in and cool milk 5/4 („) =	0 5 4			
1 „ weigh milk 5/4 („) =	0 5 4			
1 woman to clean buckets and utensils =	0 4 0			
	30 × £3 6 0 =	£99	0	0

Fourteen Weeks' Summer.

		£	s.	d.
4 men to milk at 7/- ... ... =	1 8 0			
1 lad to weigh at 5/- ... ... =	0 5 0			
1 „ carry in and cool at 5/- ... =	0 5 0			
1 woman to clean buckets and utensils =	0 4 0			
	14 × £2 2 0 =	29	8	0
Milk cart, horse, and driver		40	0	0
Depreciation in value of cow, bought a heifer at £20 and sold in 5 years at £15 = £1 per year per cow		40	0	0
Losses in death, abortion, and veterinary expenses—£1 per cow ...		40	0	0
Expense of bull 5/- per cow		10	0	0
Up-keep of dairy utensils 5/-		10	0	0
	40)	767	15	6
	Per cow	£19	3	10

	£ s. d.	
Produce per cow: 600 gallons milk at 8*d.* =	20 0 0	
Value of calf ... ... =	2 10 0	
	£22 10 0	
	19 3 10	
Balance	£3 6 2	gross profit
To Railway Company: carriage of milk, 600 gallons at 1*d.* per gallon ... ... =	2 10 0	
	£0 16 2	net profit per cow

The yield of 600 gals. is regarded as much above the average yield of the average cow throughout the country. On the other hand, the cost of feeding and attendance at Kelmscott is perhaps somewhat higher than in the case of most farmers. The figures show clearly the advantage of keeping

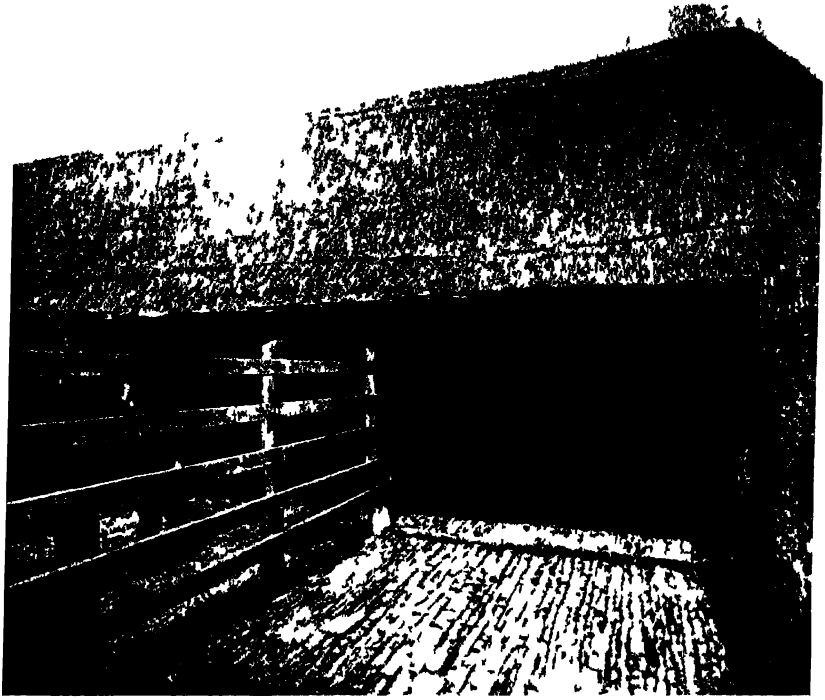


Fig. 3. Open Air Bull Shed
(All the bull sheds at Kelmscott are open fronted like this.)

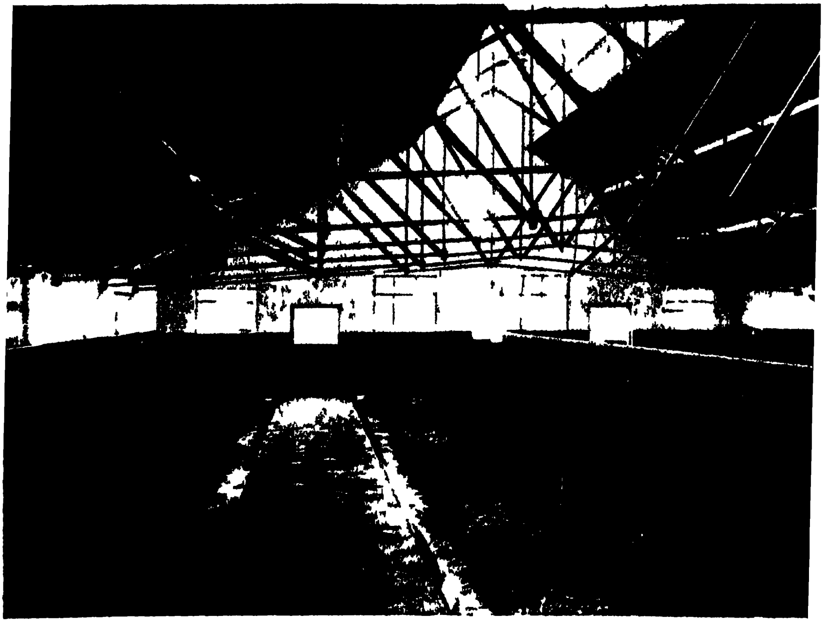


Fig. 4. One of Lord Rayleigh's New Cowhouses

a 700 gals. instead of a 500 gals. cow. The former would give a net profit of £3 14*s*. 6*d*., while the latter would give a loss of £2 2*s*. 2*d*. Nothing is charged in the balance-sheet for chopped straw and litter, as the manure obtained is believed to be of equal value.

A FARM WHICH OWNS ITS OWN MILK SHOPS.

Lord Rayleigh sends to London from his estate at Terling, near Witham, Essex, the milk of about 900 cows daily, and markets it through his own shops in the West End, of which there are now twelve. The area of the farms is in all about 4,000 acres.

The method of business is for the milk to be sold to the depôt adjoining Hatfield Peverel station, where it undergoes the process of cleaning, pasteurising, and cooling. It is then put on the railway platform. The milk is sold to the shops by the depôt.

About £3,000 has been spent recently on the construction of modern cow-houses of an excellent type, and some building is in progress. All the houses are kept whitewashed and disinfected. It is a rule that the cows shall be kept clean by grooming with currycomb and brush twice a day. All cows are inspected monthly by a veterinary surgeon, who is under contract to attend at any time when called upon. Every milker is provided with two white coats and aprons, which must be changed once a week.

The cows are chiefly Shorthorns. There is a herd of Holsteins and crossbreds kept. An effort has been made to bring in good milkers, but extravagant prices have not been paid. Breeding is done wholly with an eye to milk. The yield of every cow is measured once a week. The cost of food is not so high as might be supposed, being about 3*s*. 6*d*., including hay, but not much hay is used.

On two of the farms, the area of which is about 2,000 acres, there are about 250 milking cows each, with some hundred young stock, 60 to 70 horses, some thirty-five sows and their progeny, and 200 ewes.

There is reason to believe that the Rayleigh milk shops are paying a dividend, which if maintained from year to year will be satisfactory.

A beginning was made with the shops twenty years ago. They are confined to the West End, as it has been found that the return from business with households which do not take large supplies of milk is not remunerative.

At the beginning of 1912 the price of milk was raised by the various milk companies to 5*d.* per quart. But the milk-sellers did not see their way to maintain this rate, for the consumption of milk was found to be falling off.

Clover Sickness.

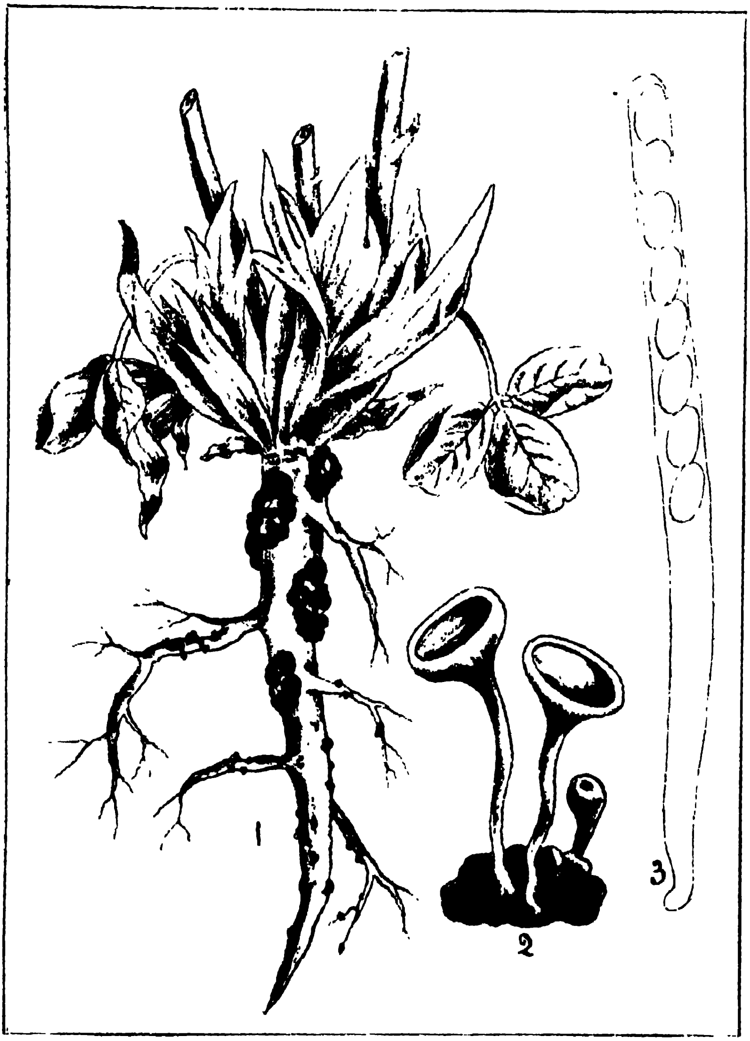
THE old idea that clover sickness is due to the exhaustion of some soil constituent essential for the growth of clover, is now disproved, and it has been definitely shown that the disease is of parasitic origin. Unfortunately two distinct parasites are equally capable of promoting the disease; the one being an "eelworm," *Tylenchus devastatrix*, Kühn,* and the other a fungus called *Sclerotinia trifoliorum*, Eriksson.

Eelworm Disease.—The earliest symptom of the presence of the eelworm disease is a yellowing and wilting of the leaves of small patches of clover. The patches gradually increase in size as the disease spreads, and may be easily noticed from a distance. Eventually the leaves droop and die, leaving bare and scorched-looking patches in the crop. The above symptoms also exactly describe the general appearance caused by the fungus—*Sclerotinia trifoliorum*—but the true cause of the disease can be readily determined by an examination of a diseased plant. In the case of the eelworm disease, the branches are much swollen and spongy at the point where they spring from the crown. If a thin slice or section of the swollen portion of the stem be examined under a microscope, numerous eelworms will be seen in the tissues, and eggs are also generally present. The eelworms, as their name implies, resemble an eel in shape, and wriggle and twist about in a lively manner; the eggs are oblong, with rounded ends, and are produced in immense numbers.

This disease is always *due to the presence of eelworms in*

---

* Eelworms affecting other crops are dealt with in Leaflet No. 46 (*Stem Eelworm*); and No. 75 (*Root-knot Disease in Cucumbers and Tomatoes*).



Clover Sickness.

1.--Root of Clover plant with sclerotia: nat. size.
2.—A sclerotium producing fruit: mag.
3.—An ascus, containing eight spores: highly mag.

the soil, and not to infected clover seed. The ease with which eelworms can be conveyed from one place to another accounts for their presence in new localities. If sheep are feeding on infected clover and afterwards removed to another pasture, their droppings frequently contain eelworms that have in no wise suffered by passing through the alimentary canal, and this is more especially true of the eggs, which are also capable of resisting desiccation for a long period without injury. Eelworms thus conveyed continue to live and increase in the soil, as they are not restricted for their food to clover alone, but can also attack many wild plants, and several kinds of cultivated plants, including oats; the latter become swollen near the base, showing the disease known as "segging" or "tulip-root." Eelworms may also be distributed in the soil adhering to cart wheels, tools, &c.

Sulphate of potash is the most effective remedy, applied at the rate of 4 cwt. per acre. When a crop shows signs of the disease, this remedy should be applied at once to the diseased patches, taking care to extend the dressing beyond the obviously diseased zone. This method will not cure diseased plants, but only prevent the spread of the disease by killing eelworms migrating from one plant to another. As this substance will not destroy the eggs it will be necessary to apply more than one dressing in order to kill the eelworms as they hatch out.

Deep ploughing is also beneficial, when conditions will allow, as it has been proved that when eelworms are buried at a depth of five inches they are killed.

Infection of the clover plant by eelworms can only occur during the seedling or quite young condition, hence sulphate of potash should be applied to the land shortly before the seed is sown, so that it may be in full activity when the clover crop is quite young.

Sclerotinia Disease.—As previously stated, the manifestations of the presence of this parasite in a clover crop are identical with those indicating the presence of eelworm. The evidence that a plant is attacked by the fungus *Sclerotinia* is the presence of one or more black, wart-like bodies attached to the root and collar. These black bodies are known as sclerotia, and consist of a compact mass of fungus spawn or mycelium, produced at the surface of the root from mycelium previously present in the tissues of the plant. When diseased plants are dead, the sclerotia remain free in the soil, and eventually produce spores, which infect future crops.

It is practically impossible to kill sclerotia present in the land, but as the parasite, so far as is known, can only attack clover, lucerne, and other leguminous plants which occur as weeds, land known to be infected should be kept free from all leguminous plants for some years. It is only by starving the fungus, through the destruction of its host plants, that the land can be freed from the disease.

Quality of Farm Seeds.

During the sowing period of last year the Board caused a short inquiry to be made into the quality of some of the commoner kinds of farm seeds.

The inquiry was directed mainly towards testing the quality of seeds that would be supplied to persons making their purchases locally, and 208 samples were procured, of which 168 were purchased by one of the Board's Inspectors in 77 centres, and 40 were forwarded by farmers.

Fifty-six of the samples consisted of seeds sold as English or Welsh red clover, 31 were white Dutch clover, 29 alsike, 10 sainfoin, 37 Italian ryegrass, 23 perennial ryegrass, 1 cocksfoot, 1 foxtail, and 20 mangold.

All the samples were analysed at the School of Agriculture, Cambridge University, with the following results:—30 samples of red clover contained dodder seeds, and in 20 of these dodder was present in considerable quantities; 8 of the samples contained both Chilian and European dodder, while 18 samples of white clover, and 19 of alsike, contained seeds of dodder.

The average real value * of the clover seeds (as calculated by the formula employed at Cambridge University) was, for red clover, 67·34 per cent., white clover, 50·6 per cent., and alsike, 54·45 per cent., while out of the total of 116 samples of clover seeds analysed only 11 gave a real value of over 90 per cent.

The average purity of the sainfoin seed was above 99 per

---

* The calculation for ascertaining the "Real Value" is

$$\frac{\text{Percentage Purity} \times \text{Percentage Germination}}{100}$$

cent., but owing to indifferent germination the average real value of the samples was reduced to 45·8 per cent. The real value figures for the samples of Italian ryegrass averaged 79·24 per cent., and for the samples of perennial ryegrass 72·5 per cent., while the samples of cocksfoot and foxtail gave real values of 88 per cent. and 61·2 per cent. respectively. The samples of mangold seed gave an average germination of 116·45 per cent., the highest being 191 per cent., and the lowest 52 per cent.

* * *

The Supply of Qualified Veterinary Surgeons for the Public Services.

The Report of the Departmental Committee on the Public Veterinary Service, the appointment of which, in August last, was announced in this *Journal* in Sept., 1912, p. 498, has been published as a Parliamentary paper (Cd. 6575, 2*d.*). The Report states that there is at present an inadequate supply of suitable candidates for civil veterinary appointments at home, in the Colonies, and in India. For the Army Veterinary Service, however, there appears to be no difficulty in obtaining suitable recruits. This was explained by the heads of the Veterinary Colleges, who stated that most of their best students, who aim at obtaining Government appointments, try first for the Army. The shortage of candidates for civil appointments is explained partly by the reduction in the total number of men who have entered the profession in recent years, and partly by the fact that, hitherto, no specific provision has been made for the education of veterinary officers who are to be employed in research and administrative work at home and abroad beyond that required for the ordinary veterinary practitioner. The most important steps which, in the opinion of the Committee, must be taken in order to improve both in quality and quantity the candidates for Government veterinary appointments are (1) to encourage a larger number of young men who have continued their general and scientific education beyond secondary school age to enter the veterinary profession; (2) to provide for men who have qualified as veterinary surgeons increased facilities to extend their knowledge, more especially in the direction of specialisation in one branch of veterinary science; and (3) to improve the system of notifying vacancies.

With regard to the first of these proposals the Report states that it is highly desirable that veterinary officers who are to become responsible for the conduct of advanced research and investigatory work (and, if possible, those who are to engage in administrative work also) should obtain a thorough grounding in general science before they commence the course for the veterinary diploma. At present, for all practical purposes, no channel exists between the university and the veterinary college, and the evidence shows that few university graduates are to be found at the colleges. The Royal College of Veterinary Surgeons prescribes a four years' course for every student without regard to any qualifications he may possess when he enters the veterinary college. The Committee, therefore, recommend that students possessing a suitable science degree should be granted exemption from one of the four years at present required for veterinary qualification, and that the requisite adjustment should be made in the course at the veterinary colleges. The Committee do not think, however, that this step alone will achieve the object in view, and they further recommend that the State should institute for a period of five years a certain number of scholarships tenable at approved veterinary colleges for three years, and of sufficient value to attract men of sound scientific training. By the end of five years the scholars selected in the first year would have been qualified as veterinary surgeons for two years, and information would be available respecting them, so that it would be possible to form some estimate of the success of the scheme. It would not be advisable to make the offer of the scholarships for a shorter period than five years, as one of the objects in view is that some young men desiring to become veterinary surgeons, and knowing of the existence of these State scholarships, may be induced to go from the secondary school to the university instead of direct to a veterinary college. In order to secure men of sufficiently high scientific training it is recommended that the scholarships be restricted to candidates who have obtained their degree in subjects cognate to their future work. The value of the scholarship should be sufficient to cover the cost of the fees and residence while attending a veterinary college. After careful consideration, and having regard to present and future requirements, the Committee consider that twelve scholarships could profitably be offered each year, each scholarship to be of the annual value of £80, and tenable for three years.

With regard to the second proposal above-mentioned, it was generally agreed among the professional witnesses that the course for the qualifying diploma was not of itself sufficient training for future officers in the Government services. It was also agreed that the courses at present provided for men after they have qualified, while of great value so far as they go, are not sufficient. These courses last for about two months only, and the evidence of most witnesses led to the conclusion that, in order to fit themselves to undertake official work at home and in the colonies, students could with great advantage spend a year in post-graduate work and study. The heads of the teaching institutions were practically unanimous in stating that many students who have shown the ability and the desire to continue their education after obtaining their diploma would be prevented from taking such a course owing to lack of means. All the members of the profession questioned on the subject testified that the institution of a number of scholarships available for men who have qualified would be attended with great benefit. For these reasons the Committee express the opinion that it is essential that the State should provide scholarships for men who have already qualified, to enable them to continue their studies with a view to enter the public services. Each scholarship should be tenable for at least twelve months at an approved institution, or institutions, either at home or abroad, where special facilities for such studies exist. It is essential that opportunity should be given for advanced study to be carried on in the laboratories of universities and other institutions which afford adequate opportunities for study and research of the kind required, and the choice should not necessarily be confined to institutions in the United Kingdom. The applications for scholarships would be considered by a selection committee comprising representatives of the Government Departments concerned, with such expert assistance as might be required, and it would probably be desirable that the number of these scholarships offered should vary from time to time, and the number to be awarded each year should be settled by the selection committee, having regard to the supply of suitable candidates and the vacancies likely to occur. With regard to the amount of the scholarships it is suggested that the best course would be that the selection committee, when recommending the award of a scholarship, should state at what institution or institutions it should be tenable, and what sum would be required to cover the cost of fees and maintenance. The annual value of a scholarship should not, however, be less than £100, and should not exceed £150.

The Committee report that improvements could be made in the existing arrangements for notifying vacancies as they occur. From the evidence received, it appears that students at the Veterinary Colleges have an opportunity of obtaining information regarding the various public and Government appointments which exist, but it is recommended that, whenever such a course can possibly be adopted, particulars of Government veterinary appointments as they become vacant should be sent by the Department concerned to the heads of each of the veterinary colleges, and also to universities and other institutions, with information as to the latest date on which applications will be received, and a statement that the vacancy will not be filled before that date.

The Committee state that the Royal College of Veterinary Surgeons is performing work of great national importance, and that its efforts to maintain a high standard of veterinary education in this country are worthy of every encouragement. In 1895 the College decided to extend the course of study for the diploma of membership from three to four years. There seems to be no ground for doubt that the standard of veterinary education was considerably raised by this action, but the number of candidates entering for the yearly examinations fell immediately the change came into operation, and has not since risen. The effect on the finances of the College has been disastrous, and the lack of funds seriously hampers its work. The Report also points out that the Government grants at present paid to the Veterinary Colleges are very small, and these colleges are probably more dependent on receipts from students' fees than any other class of educational institution of the same grade. The Committee think that the time has come when increased financial assistance should be given by the Government to institutions devoted to veterinary teaching, the efficiency of which is of great importance to the State.

In concluding their Report the Committee express the belief that the adoption of the recommendations above-mentioned would lead to the more general recognition of the veterinary services concerned as constituting an essential part of the Government administration.

Marram Grass for Paper-making.*

Among plants suggested as suitable for the paper-maker which have recently been examined at the Royal Botanic Gardens, Kew, is the common Marram Grass of our coasts, *Ammophila arenaria*, Link.

This grass, as is well known, is grown on the sand hills around our shores and acts as a very valuable sand-binder. It now appears that it possesses quite useful qualities as a source of m paper-making. Messrs. Clayton Beadle and Ste kindly examined a consignment of Marram Grass sent through Kew from the Norfolk sand hills. The grass was boiled under pressure, without passing through crushing rollers, and then bleached. The figures for the yield of unbleached and bleached fibres, expressed on the original green weight of stem as received and on the dry weight, are as follows:—

	Green Stem.	Dry Stem.
Unbleached	17·7 per cent.	31·4 per cent.
Bleached	13·1 ,,	25·0 ,,

The average length of unbeaten fibres contained in the pulp taken on an average of ten measurements was found to be 0·65 mm.

Marram Grass is found to produce a soft pulp with a short tear which more nearly resembles in general feel and external appearance the pulp produced from Esparto or chemical aspen wood pulp.

The primary function of Marram Grass is, of course, as a sand-binder, but it is possible that should it be deemed of sufficient importance as a paper-making material its cultivation could be extended over considerable tracts of sandy country bordering the coast in various parts of the British Isles.

---

* *Kew Bulletin*, No. 9, 1912.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Effect of Manures on the Herbage of Grass Land (*Roy. Agric. Coll., Cirencester; Agricultural Students' Gazette, December,* 1912).—A simple manurial experiment was carried out in 1912, at a considerable number of centres on meadow and pasture land, and in four cases a botanical analysis of the herbage on the different plots was made by Mr. R. G. Stapleton. At each centre three duplicated plots on the meadow land were laid out, one receiving no manure, a second sulphate of potash and superphosphate, and the third sulphate of potash, superphosphate, and sulphate of ammonia. The general results may be summarised as follows:—

1. The dressing with superphosphate and sulphate of potash more than doubled the percentage of leguminous plants, but rarely reduced the percentage of weeds. White clover on the deeper soils and meadow vetchling on the shallow soils were the leguminous plants most affected, although at one centre a considerable development of red clover and yellow suckling clover was produced.

[illegible] application of a complete mixture of manure containing [illegible] ammonia, as well as superphosphate and sulphate of potash, [illegible] the whole in a slight decrease in the proportion of leguminous plants as compared with the unmanured plots, though in two cases the proportion of white clover was slightly increased. The percentage of weeds in the pasture was practically halved as a result of this dressing. On an average, buttercups were the plants most affected, their proportion having fallen to one-fifth of that on the unmanured plot. This reduction was due to an actual decrease in the number of plants, the quantity per acre being reduced to less than one-half their original figure.

3. Of the valuable grasses, perennial ryegrass was the one which benefited to the greatest extent by the addition of sulphate of ammonia to the mineral manures. Meadow foxtail, where present, was also greatly increased. Golden oat grass, hard fescue, cocksfoot, and the meadow grasses were slightly affected.

Of the less valuable grasses upright brome showed a considerable decrease, and fiorin and Yorkshire fog a marked increase as the result of an addition of sulphate of ammonia.

4. At one centre where the dressing of superphosphate and sulphate of potash was compared with an application of basic slag, the former proved more successful. This was rather to be expected, as the soil contained an abundant supply of lime.

Survey of the Soils and Agriculture of Shropshire (*Shropshire C.C.; G. W. Robinson*).—This work was carried out for the Shropshire Education Committee in 1910–11 by Mr. G. W. Robinson, B.A., with the assistance of the School of Agriculture of Cambridge University. Numerous samples of the soil and subsoil were taken from land on the various geological formations of the county, and the results of the mechanical and chemical analyses of the sample are contained in this report. The bearing of a soil survey on agricultural practice is shown, and conclusions as to the manuring and treatment of soils are given. An interesting account of systems of farming—past and present—in the county is also incorporated.

---

* A Summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Manuring of Mangolds (*Univ. Coll. of N. Wales, Bangor, Agric. Dept., Rept.* 6, 1912).—Trials were carried out at ten centres in 1912. The main results are considered to be:—

(1) That it is a waste of farmyard manure to give very large dressings to mangolds. The extra weight of crop produced by quantities of farmyard manure in excess of the first 10 tons is so small that it would probably be much more profitable to give this excess of manure to some other crop and limit the quantity given to the mangolds to 10 or 12 tons per acre.

(2) That it pays well to give a moderate dressing of artificial manures, supplying nitrogen, phosphates, and potash, in addition to 10 tons of farmyard manure per acre. One of the most profitable dressings used in these experiments was found to be 10 tons farmyard manure, 128 lb. nitrate of soda, 349 lb. superphosphate, and 82 lb. muriate of potash per acre.

(3) That, if for any reason a larger dressing of farmyard manure than 10 tons is given, it probably pays to increase the dressing of artificials as well.

(4) That nitrate of soda is a better source of nitrogen for mangolds than sulphate of ammonia.

FIELD CROPS.

Varieties of Wheat and Barley (*Norfolk Agric. Stat., Guide to Expts. at Station Farm, Little Snoring,* 1911–12).—Thirteen varieties of wheat have been grown during the last three years. Carter's Standup, Square Head's Master, and Browick were used as standard varieties, and some French wheats, and three hybrids produced by Professor Biffen at Cambridge, were compared with them. The French wheats did not give very striking results. Sensation gave a good crop in both the years it was grown. Red Marvel gave a good crop the first year when autumn sown, but did not succeed as a spring wheat. Of the hybrids, Little Joss was the best. It produced a good crop both years it was grown. The station also received statistics from twenty-eight places where it was grown in 1911, and the average yield of Little Joss at these was 44 bush. per acre, as compared with 39 bush. of Square Head's Master. It is concluded from this that Little Joss is a safe wheat to rely on for a crop. Its grain was usually found to be plump, but while it weighed well owing to its freedom from rust, it was not appreciably better than the ordinary varieties for baking. Burgoyne's Fife did not appear to suit the soil and climate of Norfolk, and Biffen's No. 1 is no longer being grown, because of its inferiority to Little Joss.

Of the barleys grown, Beaven's Pedigree Archer was the best. On five plots it yielded on an average over 12 coombs of 16 st. per acre, an excellent performance considering the season. Two other selected Archers did not do so well, but may improve. Three hybrids from Plumage and Archer, produced by Beaven, gave excellent yields, and trials with them will be continued.

Growth of Sugar Beet (*Univ. Coll. of N. Wales, Bangor, Agric. Dept., Rept.* 4, 1912).—Trials were carried on at eight centres in 1912 for the purpose of testing the possibility of growing sugar beet as a farm crop in Anglesey. At each centre one-eighth of an acre was grown, and the seed, at the rate of 24 lb. per acre, was sown as if it were part of the mangold crop, without any other preparation than that usually given to mangolds, except that each plot was given a dressing of artificial manures at the rate of 3 cwt. of superphosphate, 1 cwt. of muriate of potash, and ¾ cwt. of sulphate of ammonia per acre. The plants were thinned and were left as nearly as possible 8 in. apart.

At one centre the crop was a failure, owing to the land becoming waterlogged.

The yield of roots at the other seven centres, the percentage of sugar in the juice, and the period of growth, from sowing to pulling, in days, are given in Table I.

TABLE I.

Centre.	Weight of roots per acre.			Percentage of sugar in the juice.	Period of growth in days.
	Tons	cwt.	lb.		
Bodafon Isaf	16	3	27	18·2	172
Gwredog...	10	14	32	17·3	149
Garneddgoch	14	16	56	18·8	168
Bodowyr Fawr	18	1	56	17·1	151
Nant Newydd...	14	15	48	16·8	175
Bodfeirig...	15	2	88	19·4	172
Plas Llandegfan	6	15	80	18·5	151
Average weights at seven centres	13	15	71	18·0	—

Remembering the unfavourable nature of the season, the results of this experiment are considered to show that good crops of sugar beet of first-class quality can easily be grown in Anglesey and in North Wales generally.

In former experiments in 1903 and 1906 an average yield of 14 tons 3 cwt. was obtained at six centres in all, the percentage of sugar being as in 1912.

Seeds Mixtures for Permanent Pastures (*Univ. Coll. of N. Wales, Bangor, Agric. Dept., Report* 2, 1912).—The second series of these experiments was started in 1909 at five farms. The plots were mown for hay in 1910, and all except one again in 1911. In 1912 they were grazed, with one exception. The results confirm those arrived at in a previous experiment on the same subject (see *Journal*, July, 1911, p. 331). A mixture recommended by Mr. R. H. Elliot, of Clifton Park, Kelso, containing burnet, chicory, and kidney vetch, but no ryegrass, gave heavy crops of hay, which in most cases paid well for the high cost of the seeds (£2 11*s*. 10*d*. per acre), and in nearly all cases produced a good close bottom, though in the present experiments it did not show any very marked superiority over the other plots in this respect.

Report 3, 1912, gives an account of a similar experiment started in 1910. The results have tended to confirm those of previous years. The report points out that there seems no doubt that the larger seedings give the better results.

Cultivation of Lavender (*Jour. Roy. Hort. Soc., Nov.,* 1912; *Miss H. C. Philbrick*).—A light sandy soil is most suitable for lavender cultivation, plants grown on such soil giving a far greater strength of perfume and bearing the cold winters better than those in rich garden soil. The plants are grown from cuttings, or slips, and sometimes from seed. The first year yields a good crop, the second the finest, and in the third year the plants must be taken up and replaced.

An article on the cultivation of lavender appeared in this *Journal* for October, 1911, p. 566.

LIVE STOCK AND FEEDING STUFFS.

Breeding Experiments with Welsh Mountain Ewes (*Univ. Coll. of N. Wales, Bangor, Agric. Dept., Rept.* 7, 1912).—Rams of the following breeds were mated with Welsh mountain ewes, 25 ewes being used in each case:—Southdown, Wiltshire, Hampshire, Romney Marsh, and Wensleydale. The lambs were sold to the butcher as they became fat. The Southdown, as in previous experiments, gave the highest percentage of lambs fit for the butcher at the earliest date, though the lambs were not the heaviest in weight. In the Wiltshire ram's lot half the ewes were barren, evidently owing to some defect in the ram, and no comparison with this breed can be made. Some of the other crosses did well, but further trials are necessary before any definite conclusions can be drawn.

Weight of Shorthorn Calves at Birth (*Roy. Agric. Coll., Cirencester, Agric. Students' Gazette, December,* 1912; *Mr. C. D. Stewart*).—Careful records of nineteen Shorthorn cows of the ordinary dairy type were kept with the results set forth in the table below. The calves were sired by a two-year-old Shorthorn bull.

Bull Calves.			Heifer Calves.		
Age of Cow.	Gestation Period.	Weight of Calf at birth.	Age of Cow.	Gestation Period.	Weight of Calf at birth.
Years.	Days.	Lb.	Years.	Days.	Lb.
8	286	68	7	280	80
5	283	83	5	287	84
4	282	84	5	279	76
9	280	58	5	274	77
6	296	115	4	288	80
5	297	112	7	282	84
7	202	98	5	293	105
8	289	98	8	287	74
4	288	77			
7	296	114			
6	289	77			

The bull calves were carried for an average period of practically 289 days, as against 284 days in the case of heifer calves. It is noticeable that the longer the period of gestation, the heavier is the calf in each case.

Fattening Bullocks (*Norfolk Agric. Stat., Guide to Expts. at Station Farm, Little Snoring,* 1911–12).—Ten English and ten Irish bullocks were fed for 27 weeks, November 8th to May 4th. All were fed on the same daily ration: 3 lb. linseed cake, 3 lb. cotton cake, and as much roots and chaff as they would eat.

The ten English bullocks weighed at the start on the average 10 cwt., and cost £16 each, or 32*s.* per cwt: At the end they weighed 13½ cwt., and sold for £23 18*s.* per head.

The ten Irish bullocks weighed 9½ cwt. each on the average at the start, and cost £17, or 36*s.* per cwt. At the finish they weighed 12½ cwt., and fetched £22 15*s.* per head.

The gain per head therefore in the case of the English beasts was £7 18*s.*, and in that of the Irish £5 15*s.*, but the difference was, in reality, due to the fact that the latter were bought in the first place at 36*s.* per cwt., and the former at 32*s.* The gain in live weight per head per week was 13·4 lb. for the English and 13·0 lb. for the Irish, and consequently, if the Irish had also been bought at 32*s.*, the result would have been equal for the two lots.

DAIRYING.

Some Factors affecting the Bacteriological Content of Milk (*Edin. and E. of Scotland Coll. of Agric., Report* 28; *Alexander Lauder and Andrew Cunningham*).—The objects of these experiments were to obtain additional information on the various factors which influence the bacterial content of milk, with a view to the fixing of a bacterial standard for clean milk, and to demonstrate the more important sources of bacterial contamination together with the methods of avoiding them. Contamination in the byre has already been shown to be the most important, and the inquiry was limited to this, contamination during transit not being dealt with. The work was carried out with the herd of the Edinburgh District Lunacy Board at Bangour Village Farm.

Effect of Grooming Cows.—The cows were groomed an hour before the evening milking, and the number of bacteria in the milk was found to average 2,464 per c.c., compared with 9,827 per c.c. at the morning milking, which was fourteen hours after the grooming. With cows that were never groomed, however, the number of bacteria was over 125,000 per c.c. There was therefore a reduction of 98 per cent. in the total contamination as the result of grooming.

Effect of Brushing the Udders.—Brushing the udders of the cows immediately before milking, in addition to the ordinary grooming, was found to increase the bacterial content of the milk greatly. When the brushing was done three-quarters of an hour before milking there was still no advantage from the brushing. This method of treating the udder is therefore unsatisfactory, owing, no doubt, to the dirt particles on the udder being loosened so that when milking begins they fall into the milk-pail.

Effect of Washing the Udders.—When the udders were washed with soap and water and left moist a large reduction was effected in the number of bacteria. The average number in samples of the milk of four cows treated in this way was only 1,125 per c.c.

Bacteria in the Air.—Foddering and grooming the cows, and the removal of manure from the byre during milking increased the number of bacteria in the air considerably.

The Keeping of Milk.—Cooling the milk immediately after milking resulted, as was to be expected, in a smaller number of bacteria than when it was allowed to cool naturally. For example, two samples of milk, one of which was cooled immediately after milking to 50° F., and the other allowed to cool in the air to 64° F., showed a vast difference in the bacterial content. The samples were kept approximately at the above temperatures for twenty-four hours, and at the end of that time they contained respectively 128,000 and 874,000 bacteria per c.c.

A large number of samples of the mixed milk of the herd at Bangour were taken as the milk left the byre, and the average number of bacteria found in them was about 47,900 per c.c. In a number of milks from town dairies which were also examined the average was about twice as high. The following recommendations for clean milk, based on the experiments, are given:—

1. The fore-milk should be rejected.
2. The cows should be groomed daily, and their udders should be washed before milking.
3. Foddering with dusty fodder, removal of manure, and all operations which raise dust and so increase the bacterial content of the air of the byre, should be done after milking, or several hours before.
4. The byre should be cleaned twice daily, and the floor flushed with water before milking.
5. The ventilation and the lighting of the byre should be efficient.
6. The milkers should wear clean overalls during milking, and should wash their hands at the commencement of milking, and also after the milking of each cow.
7. The milk should not be allowed to stand exposed to the air of the byre after milking. It should be removed to a cool, clean dairy, where it should be immediately cooled to 10° C. (50° F.), and kept cool.
8. All milk vessels, &c., should be thoroughly sterilised with live steam, and should not be allowed to stand in the byre before milking begins. They should not be rinsed with cold water or wiped with a cloth after steaming, but simply set up to drain.
9. The use of unclean cloths is a frequent source of bacterial contamination, and should be carefully avoided.

FORESTRY.

Experimental Forestry in Wales (*Trans. Roy. Scot. Arbor. Soc., January,* 1913).—Fifty acres of land were presented in 1906 to the County Council of Denbighshire for the purpose of the establishment of an experimental area in forestry. A forest nursery was formed in the spring of that year, and in the following season planting operations were commenced by the Forestry Department at Bangor College.

The area is ordinary hill land of the "mountain and heath" description, and stands at an elevation of from 950 to 1,250 ft. above sea-level. The soil is a light, weathered shale overlying Silurian rock.

About 116,000 trees have been planted in plots with a shelter-belt.

The sum of £386 was expended for the planting of the 50 acres, this including the cost of plants and fencing; the necessity for dividing the plants into plots of different species made this expenditure unduly high.

Very few *broad-leaved* trees were planted, the reason being that the elevation and character of the soil make the area more suitable for coniferous species. On the whole, the broad-leaved trees have done badly, the only exception, at present, being *beech*. The conifers which have grown most rapidly up to the present are the Douglas fir, European and Japanese larch. One plot of *Douglas fir*, growing at over 1,000 ft. elevation, shows an average height of 8 ft. 6 in., although only planted in 1907. The growth for the past three years has averaged 2 ft. per annum. It has been found best to use three-year-old transplants of this species, about 1 ft. in height, rather than nursery stock of larger size. There have been only 3 per cent. of deaths among Douglas firs.

The growth of *Japanese larch* thus far compares favourably with that of the common species. On one of the most exposed plots, Japanese larch, 10 in. in height, when planted in the spring of 1907, made a growth of 1 ft. or more per annum from 1908 onwards, and in December, 1912, were 6 ft. 9 in.

One of the most promising species experimented with is Sitka spruce.

The arrangement of the shelter-belt is as follows:—To the outside, where the trees bear the brunt of the storm, are placed the mountain pine and white American spruce. Further in occur sycamore, Norway maple, hornbeam, birch, white alder, ash, rowan, Norway spruce, Corsican pine, Austrian pine, Scots pine, and silver fir. The strip is 60 ft. wide, and a planting distance of 6 ft. has been adopted.

Methods of Planting.—The plants as a whole were planted by the method known as "holing," the work being done with a heavy, narrow-bladed hoe, or mattock, followed by a trowel to aid in the insertion of the plants. Tests were, however, made with ordinary notching and vertical notching. Under the holing system, gorse and other weeds were removed from a patch about 15 in. square before the soil was stirred with the mattock. The plants, therefore, made a better start, and this advantage has been maintained as compared with the notched-in plants. Common spade notching resulted in a greater number of deaths, and entailed more expense in weeding. This, as well as the effect on height-growth, will be seen from the table given below:—

Species.	Number of Deaths.		Percentage of Deaths.		Height when Planted.		Height, Dec., 1912.	
	Notching.	Holing.	Notching.	Holing.	Notching.	Holing.	Notching.	Holing.
					ft. in.	ft. in.	ft. in.	ft. in.
Larch ...	114	34	10·8	3·1	1 3	1 3	3 6	4 6
Scots Pine	34	9	3·1	0·8	0 10	0 10	2 5	3 2
Spruce ...	18	5	1·6	0·1	1 4	1 4	2 2	2 7

Vertical notching was carried out with a heavy iron wedge-shaped implement, and two-year seedling plants were used. Excellent results have been obtained with the larch, and the Scots pine has done moderately well. The small plants of spruce have, however, been almost entirely crowded out by the grass and gorse.

Fencing.—The cost of erecting a wire-netting fence for the exclusion of rabbits was £80 4*s.* 10*d.* The fence has been regularly inspected, a man being paid £3 18*s.* annually for the work.

The cost of cleaning has not exceeded £20 since the commencement —equivalent to an expenditure of about 2*s.* per acre per annum over the area planted. Maintenance charges, including the payment of a fire insurance premium and regular examination of the fences, come to £19 2*s.* 3*d.*

The carting of plants from the railway station and from the nursery added 1*s.* 3*d.* per 1,000 to the cost. The expense on plants which passed through the home nursery was 8*s.* 4*d.* per 1,000 for each time of transplanting. The cost of planting was 22*s.* 10*d.* per 1,000 plants.

Tests are being made with a view to finding out which species are most suitable for the class of ground experimented on, the rates of growth of each, and the advantage of certain mixtures; while investigation is also being made into the effects of insect pests, fungus diseases, frost, and wind. Later on, thinning experiments will be made, and the volume of timber produced will be recorded.

Protection of Young Spruce from Frost (*Trans. Roy. Scot. Arbor. Soc., January,* 1913).—Attention is drawn to the value of alder and birch in protecting young spruce. The alder grows rapidly and soon gets ahead of the spruce, necessitating an annual pruning of the lower branches so as to admit light and air to the spruce beneath it. Further, the side branches of the alder spread very rapidly, and afford protection to the spruce from frost in winter and the searching rays of the sun in summer; this benefit is proved by the healthy, dark-green appearance of the young spruce underneath it, and by the rapid growth which they make after they are once fairly established.

Results obtained on a plantation in Yorkshire are mentioned, where spruce and larch are mixed with hardwoods, oak and ash on the outside of the plot, while the wet, low-lying centre of the plot is planted with spruce mixed with alder. The alders are about 12 ft. apart, and were originally planted solely on account of their suitability to the soil. They have proved a splendid protection to the spruce, however, a frost at the end of April which scorched dozens of spruce on the outside of the wood leaving unharmed the spruce mixed with alder. The alders were between 3 and 4 ft. high when planted, and grew very rapidly, and some of the best of them are now from 12 to 15 ft. in height and nearly 12 in. in circumference.

Where the soil is not suitable for alder, it is stated that birch would answer the same purpose.

NOTES ON AGRICULTURAL CO-OPERATION.

The Management of a Pig Club.

The welfare of a live-stock insurance society depends to a great extent on the care which has been taken by the members in drawing up the rules by which its affairs are to be governed, and the case of a society threatened by failure as a result of its having worked under rules which were capable of improvement in several directions was recently brought to the notice of the Board. The society in question—the Aberford Pig Insurance Club—after an existence of nearly fifty years, had applied in May last to the Registrar of Friendly Societies for dissolution, and the Board deputed an inspector to inquire into its working, with the result that various suggestions were made to the club as to the way in which its management could be improved.

Contributions towards Management and Insurance Funds.—It was found that no distinction was made by the club between management and insurance transactions, there being only one general fund to which all receipts were credited and against which all payments were charged. Each member on joining paid 1*s.* entrance fee, and made a contribution of 1*s.* a year towards management expenses. As regards any further contribution, the rules laid down that each member should contribute the sum of 6*d.* per month until the sum of £15 was raised, the subscriptions then ceasing until the fund fell to £10, on which the contributions were recommenced and continued until the fund again reached £15.

Under this rule the reserve fund could at no time remain long much above £15, and the contributions in excess of the fixed 1*s.* a year varied considerably according to the number of deaths among the insured pigs. It was the need for special contributions of 6*d.* a month in order to raise the reserve fund from £1 14*s.* (to which sum it had fallen early in 1912) to £15 which led to a crisis in the club's affairs.

The effect of the rule as to the reserve fund was that the club lost all the advantages of feeling secure from the necessity of making exceptional contributions to meet exceptional losses, and of receiving a considerable income from interest, which are conferred by the possession of a large reserve. For instance, the Kemerton Pig Club, in Gloucestershire, has a reserve fund of £177, on which it receives as interest an annual income of £4 5*s.* It is much better to pay a reasonable premium regularly than to pay an unduly small sum in good years and to have to supplement it by heavy levies in bad years. The proper course for the Aberford Society appeared to be to alter its rules and lay down that until the reserve fund exceeds £100, or 10*s.* per animal insured, the members should regularly pay premiums on all pigs insured, in addition to the 1*s.* a year for each pig which they pay towards expenses of management. As required by the law and rules, a separate account should be kept of costs of management, and any balance to the credit of the society in the management account should be carried year by year to the insurance fund so as to swell the reserve.

Rates of Insurance.—No differentiation was made by the club as regards rates of insurance between a breeding sow and a store pig, whereas almost all other societies charge for a sow a premium at least double that charged for a store pig. The reason for this is obvious. A breeding sow may be under insurance for several years, during which her chances of contracting disease and dying are much greater than those of a store pig, and if she does die the loss to the club is likely to be much larger than on the average pig (it was a breeding sow which involved the club this year in a loss of £7). The death-rate among sows in the Scawby Club has been double that among store pigs, and the loss to this club on each breeding sow has averaged twice as much as the loss on each pig that died, so that it would seem that the premium on the breeding sow should be four times that on a store pig. The members of the Aberford Club have for the last nine years been able to insure their pigs against death by disease or accident on payment of a total average charge of 1*s.* 4*d.* per pig insured, whereas on the average of other societies the total cost of insurance generally comes to about 2*s.* 4*d.* per pig per annum, so that it would seem that suitable premiums for the Aberford Club would be 1*s.* a year for every store pig and 4*s.* a year for every breeding sow or boar, and that these rates would be sufficient to meet losses and gradually to build up a reserve fund of a substantial amount.

Number of Animals Insured by each Member.—The Aberford Club allowed a member to insure only one pig or sow, and it was left to the member to select which animal he would insure. It was natural for him to select his more valuable animal, especially if he thought there was more risk of its contracting disease, and to leave uninsured his less valuable and more healthy animals. It would appear to have been wiser for the club to have adopted a rule that each member must insure all his insurable animals, so that the club might have the benefit of the premiums on the less valuable and more healthy animals as well as on the others.

Maximum Payments for Animals that Die.—The club did not fix any maximum to the amount payable on the death of an insured animal, the rule being to pay seven-eighths of the value of the pig at the time it fell ill. It might be advisable to prescribe that in no case would the club pay more than £5 on any single animal.

Reduction of Death-rate.—With a view to the reduction of the death-rate it was suggested that a rule might be passed by the society to the effect that it will cancel the insurance of any pigs kept in an obviously insanitary condition, and will refuse to pay insurance on any pig which has been carelessly exposed to risk by its owner or improperly treated by him when it was ill. Another good rule would be that no claim will be paid on any pig until the marker or a member of committee has seen it dead. The marker, who has to pass pigs for insurance, and value them when ill, should be carefully selected and retained in the post so long as he gives general satisfaction, instead of being frequently changed.

It is satisfactory to be able to record that the society amended its rules on the lines recommended by the Board, and withdrew its application for dissolution.

Wem Cow Club.

Wem is a small market town in North Shropshire. The parish has a population of about 4,000, and an area under crops and grass of about 13,000 acres, of which nearly 10,000 acres are under permanent grass. The chief agricultural occupation is dairying, and there are in the parish about 5,500 cattle, of which 3,000 are cows or heifers in milk or in calf. There were last year about 280 holdings above one acre, of which 200 were under 50 acres in extent.

In 1866 a number of small holders formed "the Wem Cow Club," which was registered under the Friendly Societies' Act in 1871, the object of the Society being "to assure against loss by death of neat cattle from disease or otherwise." The number of members has during the last ten years increased from 58 to 68, and the number of animals insured from 164 to 244. The members are mainly small holders, but the Society also includes a number of cottagers and labourers, besides a builder, a roadman, a post-master, a gamekeeper, a draper, and a grocer.

Most of the members reside within four miles of Wem, but a few who live a little farther off have been admitted as members. The affairs of the Society are directed by five stewards—all of whom are small-holders—by a treasurer, and a secretary. Each of these seven members of the Committee is allowed 2*s.* 6*d.* out of the funds of the Society for each quarterly meeting he may attend.

The rules lay down, as required by the Act, that a separate account shall be kept of the expenses of management of the Society, and of all contributions given thereto, but as a matter of fact no such separate account is kept, the expenses of management being charged to the insurance fund.

During the last two years, the total expenses of management have amounted to about £8 a year, including £1 paid to the secretary, £3 10*s.* paid to the treasurer and stewards, and £3 subscribed to the Wem Agricultural Association to be given back in prizes to members of the Cow Club. Thus the cost of management averages about 8*d.* per animal insured per annum, whereas for cow clubs generally in England and Wales the cost of management averages only about 4*d.* a head. No separate contribution is charged for management expenses. A new member on admission pays an entrance fee of 1*s.* 3*d.* per cow and 9*d.* per calf, and insurance premiums are payable quarterly at the same rates, that is to say, at the rate of 5*s.* per cow and 3*s.* per calf per annum. Each member is required to insure all his insurable animals.

On the average of the last ten years the Society insured annually 155 cows and 43 calves, a total of 198 animals, and the total amount received in premiums averaged £43 12*s.* 2*d.* per annum, an average of 4*s.* 5*d.* per animal insured. There was a further income averaging £2 16*s.* 2*d.* for interest and £2 16*s.* 1*d.* from the sale of carcasses, and the total income of the insurance fund averaged £49 12*s.* 4*d.* per annum. Against this the average amount paid on claims was £37 15*s.* 6*d.*, which gives an average of £8 4*s.* per animal that died and of 3*s.* 10*d.* per animal insured; but as the costs of management were charged to the insurance fund, the total expenditure of that fund averaged £45 8*s.* 6*d.* per annum, against the average income of £49 12*s.* 4*d.* So that in the course of the ten years the Society saved altogether £42, and the reserve fund, which was £103 at the beginning of the period, amounted in 1911 to nearly £146, which is enough in itself to cover nearly four years' average losses. Three years ago the reserve fund stood at £186, but during 1910 and 1911 the losses have been above the average, especially during 1911, when eleven cows died, chiefly, it is said, from eating too many acorns. This, however, was an exceptional loss, and to judge from the experience of the last ten years, the Society need expect an average death-rate of only 2·3 per cent. per annum, which compares favourably with 2·4 per cent., the average death-rate for 22 cow clubs in England and Wales during 1910 and 1911.

Co-operative Credit in India.

In India, with its immense area and its population of 315 millions, the cultivation of the land is almost entirely in the hands of small-holders, farming from 1 to 50 acres each. Many of them own the land they cultivate; but even where this is the case, they find great difficulty in obtaining at a reasonable rate of interest the capital they require to borrow in order to carry on their agricultural operations. In many parts of the country the ordinary rate of interest charged to the peasant by the village moneylender, who is the main source of supply of credit, is from 30 to 40 or 50 per cent. per annum, and for the whole of India the average rate is somewhere in the neighbourhood of 20 per cent. These high rates are due to the precariousness of the harvests, to the scarcity of capital available for loans as compared with the demand, and to the unsatisfactory relations between the moneylenders, who often take advantage of the ignorance and illiteracy of their debtors, and the peasants, who struggle to avoid the exorbitant claims of their creditors and are often unpunctual in the repayment of their debts.

With a view to improving the security of lenders and reducing the rate of interest payable by borrowers, the Government of India in 1904, after a careful study of the experience gained in various European countries, resolved to introduce the system of co-operative credit, which had been so successful elsewhere, and passed a Co-operative Credit Societies Act, based upon that experience and upon the Friendly Societies and Industrial and Provident Societies Acts of the United Kingdom, with such changes as were necessary to adapt them to Indian conditions. That this measure has proved a success beyond the dreams of its most enthusiastic advocates, will be seen from the following statistics for the year 1911–12.

In that year the total number of co-operative societies in India increased from 5,432 to 8,177, the number of members rose from 314,000 to 403,000, and the total working capital from £1,358,000 to £2,238,000. The amount issued in loans to members during the year was £1,191,000. It must be remembered that a pound in India means much more than it does in England, as may be realised when it is considered that the average daily wage of an unskilled agricultural labourer is about 3*d*. in India, while in this country it is about 2*s*. 6*d*., or ten times as much. The amount lent by societies to their members last year would, if spent entirely in wages, have enabled them to employ 95 million days' labour, and if spread over the total number of members, would have provided each of them with enough to pay the wages of a labourer for two-thirds of the year.

The societies are divided into three classes—central, urban, and rural—and the following figures relate to rural societies, which are almost entirely composed of small cultivators living in villages. The number of these rural societies increased during the year from 4,957 to 7,562, the number of members from 236,000 to 325,000, and the working capital from £727,000 to £1,215,000. During the year members deposited with the societies £85,000, and repaid loans to the amount of £503,000. Deposits were withdrawn to the amount of £52,000, and the new loans made to members amounted to £935,000. The earnings of the year, which consisted almost entirely of interest on loans to members, were £115,000, and the charges of the year were £73,000, so that the societies during the year made a net profit of £42,000. At the end of the year the total assets of these rural societies amounted to £1,295,000, of which £1,112,000 were out on loans to members. Their liabilities to persons and bodies outside the societies amounted to £853,000, including £658,000 due to central banks and other societies, £126,000 borrowed from non-members, and £51,000 lent by the Government in certain parts of the country, so that, after deducting these liabilities to outsiders, the societies and their members between them ended the year with net assets of the value of £442,000, which represents the sum which the establishment of these credit societies has enabled their members to lay by in the course of the last eight years. Of this amount £300,000 were due to individual members in the form of share capital, deposits, and interest, and after allowing for this amount and some other small items, the societies, as such, possessed £140,000, which represents their profits to date from the commencement of the different societies.

This satisfactory result is due mainly to the success of the societies in obtaining advances and deposits, either from members or non-members, at a considerably lower rate of interest than they charge on loans to their members. The rates which the societies find it necessary to pay in order to secure the capital required for their working vary from about 6 to 10 per cent., and average something like 7 per cent. for the whole of India; and the rates charged by the societies on loans made to their members vary from about 10 to 15 per cent., and average for the whole of India approximately 12 per cent. The amount of interest earned by societies during the year exceeded the amount of interest paid by them by £45,000, which left them a margin of profit of nearly 5 per cent. on the amount borrowed by them from all sources; and as the committees which manage these societies perform their work without payment, the total cost of administration for the whole of India came only to £8,000, or a little more than £1 per society for the year. Thus the members of these societies have not only found them a safe place of deposit for their savings, but have been able to borrow the small loans they require at a rate of interest which, though it seems high in comparison with the rates current in Western countries, is only about half the rate they used to pay to the village moneylender. The more successful societies, which have built up a large reserve fund, are now beginning to reduce the rate of interest they charge on loans to their members.

The indirect advantages of the movement are also very marked. The establishment in a village of a successful credit society among the peasants themselves has greatly reduced the demand for loans from the village moneylender and compelled him to lower the interest he charges to other persons who still resort to him for loans. The manifest benefits gained from co-operation in the matter of credit are encouraging the villagers to combine for other purposes, and one hears of co-operative societies formed for the provision of good seed or improved implements, for the purchase of members' requirements, and for the sale of their produce. Some societies have even begun to take up land for demonstration farms, to build village halls, and to start village schools for the benefit of their children. It is also noted that these societies play an important part in the prevention of disputes and litigation, and bring the people together in friendly fashion, so that the practice of co-operation is having a marked influence on the effacement of old enmities and the development of social intercourse among the villagers. The movement is rapidly spreading, and promises to revolutionise village economy throughout the country, by increasing the welfare and raising the intellectual and moral standard of the masses of the people.

The Government of India has now acquired a wide experience of its own in the matter of agricultural co-operation, and last year, in accordance with that experience, amended the law on the subject and passed an Act "for the promotion of thrift and self-help among agriculturists, artisans, and persons of limited means," by encouraging the formation of societies which have as their object the promotion of the economic interests of their members in accordance with co-operative principles. This Act applies to all forms of co-operation, but in the meantime it will chiefly affect co-operative credit societies, which so far in India have usually been based on the principle of unlimited liability of the members for the debts of the society; indeed, of the 7,562 rural societies, 7,239 are formed on this principle. Provision is, however, made for societies with share capital and limited liability. The societies, which are mainly composed of peasants who can neither read nor write, are placed under the control of the local Government acting through the Registrar of each province, who has power to refuse registration, to criticise a society's rules, to require it to have its accounts audited by some person authorised by him, and to wind up compulsorily any society whose affairs are mismanaged. On the other hand, the societies are given certain privileges, such as exemption from income tax and stamp duties, priority over other creditors in certain cases when enforcing demands due from members, exemption of members' shares in the society from attachment or sale under a decree of court, and the right of members to nominate persons to whom their shares shall pass on their death. The members greatly value the audit, inspection, and advice of the official staff (almost entirely composed of Indians), who travel about the country, examining the affairs of existing societies, and aiding in the establishment of new ones.

The following information with regard to the credit banks of the Russian zemstvos is given in the *Bull. Econ. and Soc. Int.*, September 1912.

The Zemstvo Credit Banks of Russia.

The zemstvos are independent administrative provincial and district institutions, founded by a law of 1867 in 34 Governments of European Russia. The various classes of the rural population are represented on the zemstvos, an average district assembly being composed of some 30 landholders, 27 or 28 peasants, and 4 or 5 town merchants, while the provincial assembly is a union of the delegates of the various district assemblies of the province. The powers of the zemstvos relate to administrative matters, justice, public assistance, and education, public health, agriculture, and trade.

History of the Agricultural Credit Movement.—Previous to 1871 there were only two co-operative credit societies in Russia, but in that year the zemstvos began to evince an interest in agricultural credit, and they granted loans to 35 agricultural co-operative credit societies which were founded during the year. In the next six years 782 co-operative societies of the same character were formed, and were subsidised by the zemstvos to the extent of £33,000. From 1878, however, the number of new societies gradually declined, and after 1887 the zemstvos ceased to take further interest in their development.

A law of 1871 authorised the zemstvos to found credit banks of their own, but remained inoperative. In 1904 an Imperial order was issued on the subject, and in 1906 regulations were issued by the Minister of Finance, providing for popular credit banks to be formed to facilitate the business operations of landholders, farmers, peasant co-operative societies, and village associations, as well as of townspeople, and placing certain funds at their disposal.

Management of the Zemstvo Credit Banks.—The management of the zemstvo credit banks is vested in at least three members, elected at the meeting of the zemstvo, and holding office for three years. The permanent committee which administers all the economic business of the zemstvo has also a share in the administration of the affairs of the bank.

The Work of the Banks.—The work of each bank, which generally extends to a whole province, consists in receiving money on deposit and granting loans. The initial capital of the bank may consist of subventions from the zemstvos, donations, deposits, or even loans. The banks are authorised to receive deposits, and the rate of interest paid is settled at the meeting of the zemstvos. The liability of the banks for deposits and loans is guaranteed by the zemstvos. Loans for permanent improvements, such as drainage of land, cutting down forests, and building mills, are granted for five years, and loans for the purchase of machinery and live-stock are granted for three years. In any other case loans are only granted for short periods. Loans to private persons must not, as a rule, exceed about £32; but if the bank is authorised to grant loans on the security of agricultural produce the amount may be up to £106. With regard to loans to collective borrowers the share of each individual must not exceed £32.

The rate of interest paid to the banks by co-operative societies is as a rule much lower than that paid by private persons, the former rate varying from 5 per cent. to 9 per cent., and the latter from 7½ per cent. to 12 per cent. per annum. The view is gaining ground that the banks should confine themselves to making loans to associations only, and should refuse to make loans to individuals. Loans to private persons have been necessary in the past on account of the lack of co-operative credit societies, and the fact that even where these existed they could not lend money either in large amounts or for long periods. The maximum amount for a loan seems to vary greatly with the various banks, one having fixed £32 and another £1,600. The interest paid to depositors varies from 2 per cent. to 8 per cent.

Progress of the Zemstvo Credit Banks.—The first of these banks was founded in January, 1907, and by the end of that year 19 banks were at work. The following table shows their subsequent progress and the extent of their operations:—

Year.	Number of Banks.	Total Credits and Debits.	Loans Granted.	Deposits and Loans Received.
		£	£	£
1909	39 (1)	271,000	223,000	121,000
1910	58 (2)	666,000	498,000	398,000
1911	78 (3)	1,523,000	1,091,000	1,009,000
1912	107 (4)	2,845,000	2,186,000	1.058,000

(1), (2), (3), and (4): data for 35, 55, 62, and 107 banks respectively.

The following information as to cattle insurance in Austria is taken from reports of the Austrian Ministry of the Interior for 1907, 1908, and 1909.

Co-operative Cattle and Horse Insurance in Austria.

There were 250 local cattle insurance societies and six provincial institutions at work in 1907; 360,331 head of cattle were insured by 115,131 members. The total value of the animals insured was £4,442,000, the average value of each being about £12 7*s*. The amount paid in premiums during the year was £65,100, or about 3*s*. 7*d*. per animal insured. The number of animals that died during the year was 9,618, this being a mortality of 2·67 per cent. The compensation paid on these animals was £105,821, or rather more than £11 per animal, so that it appears that nearly the full value of the animal is paid. About £38,283 was recovered by the insurance societies through the sale of carcasses, &c., so that the net compensation was only £67,538 on 9,618 animals. This sum, however, was larger than the amount received in premiums, the loss over the 256 societies being £2,440.

The reports of the Austrian Ministry of the Interior for 1908 and 1909 do not contain statistics relating to local cattle insurance societies, but are limited to giving the profit and loss accounts and the balance-sheets of the principal provincial mutual cattle insurance societies. The largest of these societies is that for Lower Austria. In 1909 it received £57,490 in premiums, £1,725 in policy dues, £2,075 in interest on reserve fund, £26,960 from the sale of carcasses, and £19,610 from other sources. The total receipts were £107,800. As regards expenditure it paid £103,420 in claims (nearly double the amount received in premiums), its working expenses were £18,800, and its total expenditure was £131,400.

The insurance of horses in 1907 was carried on by five provincial societies and 72 local societies; 39,852 members insured 86,937 animals of the value of £2,047,000 (or £23 10*s.* per horse). The amount paid in premiums during 1907 was £46,720, *i.e.*, 10*s.* 9*d.* per animal. The number of horses that died was 3,213, *i.e.*, the death-rate was 3·7 per cent. The amount paid in compensation was £54,000, or about £16 16*s.* per animal that died, equal to about 70 per cent. of its insured value. The amount realised from the sale of carcasses, &c., was £6,780, so that the net compensation was £47,220. There was therefore a loss of £500 on the working of the 77 societies during the year. The provincial institutions for the insurance of both cattle and horses receive grants from the State to the extent of 12 per cent. of their receipts. (*Bull. Bur. Econ. and Soc. Int.*, August, 1912; see also pp. 959–960.)

OFFICIAL NOTICES AND CIRCULARS

Foot-and-Mouth Disease.

The restrictions applying to the Foot-and-Mouth Disease infected place at Kennington, near Ashford, Kent—referred to in last month's *Journal*—have been withdrawn by the Board, and there are now (February 10th) no restrictions of the Board in force in any part of Great Britain in connection with any outbreak of the disease.

The Board made an Order on January 28th regulating the landing in Great Britain of cattle, sheep, goats, or swine brought from Ireland. The Order superseded the existing Orders on the subject which were issued by the Board in connection with the existence of Foot-and-Mouth Disease in Ireland.

Under the new Order, cattle, sheep, goats, or swine can be landed at authorised landing places, at which they can be fed and watered, and kept under detention and supervision of Veterinary Inspectors of the Board for a short period, after which they may, if found to be free from any scheduled disease, be moved out to any market or farm in Great Britain, excepting districts where the admission of Irish stock is prohibited by regulations made by Local Authorities; or, if the owners so desire, the animals may be slaughtered at the landing place.

The Board at the same time made a further Order withdrawing the existing prohibition against the landing in Great Britain of hay or straw brought from Ireland.

The Orders came into operation on January 30th.

Recent Leaflets.

The Board published the following new leaflets in 1912:—No. 260, *Statistics of Agricultural Co-operative Credit Societies in England and Wales*; No. 261, *The Scawby Agricultural Credit Society*; No. 262, *Tomato-Leaf Rust*; No. 263, *Mustard Beetles*; No. 264, *The Cultivation of Onions*; and No. 265, *Utility Rabbit Breeding for Small Holders.*

New editions of the bound volumes of the Board's leaflets have also been issued, viz:—

Leaflets Nos. 1–100; Tenth Edition (with Index.)

Leaflets Nos. 101–200; Third Edition (with Index).

New editions of the following leaflets have been issued, the information in a number of them having been substantially revised:—

No. 6.—*Voles and their Enemies.*

No. 10.—*Wireworms.*

No. 20.—*The Magpie Moth.*—Information as to spraying revised.

No. 32.—*Foul Brood, or Bee Pest.*—A description and symptoms of a third type of the disease, viz., Sour Brood, have been added.

No. 35.—*The Celery Fly.*—Note on protection of seedlings added.

No. 38.—*The Carrot Fly.*

No. 44.—*The Lapwing, Green Plover, or Peewit.*

No. 55.—*The Swallow.*—This leaflet contains new illustrations.

No. 58.—*Nematode or Round Worm Disease of Poultry.*

No. 59.—*Improvement of Land Acts.*—This leaflet has been rewritten, and gives details of various improvements which may be the subject of a charge under the Acts.

No. 68.—*Currant Aphides.*—Mention is made of a further Aphis (*Aphis grossulariæ*), as harmful to red currants and gooseberries.

No. 72.—*The Purchase of Artificial Manures.*—This leaflet has been rewritten and the prices of manures have been revised.

No. 75.—*Root-Knot Disease in Cucumbers and Tomatoes.*—The methods of prevention and remedy have been revised.

No. 77.—*Finger-and-Toe in Turnips.*

No. 83.—*Preservation of Eggs.*—A further method of preserving eggs for domestic purposes is included.

No. 109.—*The Cabbage Moth.*—This leaflet has been rewritten, and contains a new illustration of the pupa.

No. 121.—*The Construction of Pigsties.*—This leaflet has been rewritten.

No. 128.—*Advice to Beginners in Bee-keeping.*

No. 130.—*Navel Ill and Joint Ill in Newly-born Animals.*—The portion dealing with prevention and treatment has been much enlarged.

No. 132.—*Slugs and Snails.*

No. 134.—*Apple Culture.*—The paragraph on Pruning has been omitted, in view of the publication of Leaflet No. 252, *Pruning of Fruit Trees.*

No. 142.—*Calf-Rearing.*

No. 146.—*The Value of Records of the Milk Yields of Cows.*—This leaflet has been rewritten, and the information brought up to date.

No. 150.—*Pea and Bean Beetles.*

No. 151.—*Cleanliness in the Dairy.*

No. 161.—*The Vapourer Moth.*—A new illustration has been inserted.

No. 162.—*Grafting Fruit Trees.*

No. 168.—*Hints on the Formation of Permanent Pastures.*—A paragraph on the treatment of the pastures in the early years of their existence has been included.

No. 169.—*The Cultivation of Mangolds.*

No. 182.—*Crimson Clover.*

No. 185.—*Bean Pod Canker.*

No. 189.—*Insurance of Farming Stock against Fire.*

No. 195.—*American Gooseberry Mildew.*

No. 211.—*Cider Orchards.*—The list of varieties of apples recommended has been revised.

No. 218.—*Associations for the Creation of Small Holdings.*

No. 223.—*The Brown Scale of the Gooseberry and Currant.*

No. 228.—*Prevention of Cruelty to Animals* (*January,* 1913).—A section on the Protection of Animals Act, 1911, has been added. (Formerly entitled *Prevention of Cruelty in the Destruction of Hares, Rabbits, Birds, and other Animals.*)

No. 229.—*The Breeding and Rearing of Turkeys.*

No. 230.—*Tomato and Cucumber Canker.*—Alternative methods of prevention are suggested.

No. 231.—*Cheese-making for Small Holders.*

No. 246.—*Prevention of Damage to Hides, Skins, and Wool.*

No. 252.—*Pruning Fruit Trees.*—The first part of this leaflet has been rewritten.

No. 253.—*Microsporidiosis of Bees or Isle of Wight Bee Disease.*—This leaflet has been rewritten and now occupies seven pages.

Bound volumes of leaflets may be obtained for 6*d.* each, post free, and single copies of leaflets free of charge and post free, on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

Destruction of Wood Pigeons.

The Board desire to suggest to landowners, farmers, and gamekeepers in the South of England that a combined effort should be made in the last fortnight in February to reduce the number of wood pigeons in their neighbourhood. A special effort should be made to shoot them in the evenings, when they are preparing to roost.

Enquiry into the Food of Birds.

The Board of Agriculture and Fisheries desire to give notice that, in conjunction with the Economic Ornithological Committee of the British Association for the Advancement of Science, they are engaged on an inquiry into the food of birds, especially those believed to be injurious to farmers and fruit-growers. Investigations are at present confined to the rook, the starling, and the chaffinch. The Board would be glad to receive the names of correspondents who are willing to send to an address which will be supplied them specimens of one or more of these birds at regular intervals during the year. Correspondents are wanted from all counties in England and Wales.

Tenth International Congress of Agriculture.

The Committee which has been formed from representatives of several of the principal agricultural institutions of this country for the purpose of securing adequate British representation at the tenth International Congress of Agriculture, to be held at Ghent, Belgium, from June 8th to 13th next, is making an appeal for adherents to this important Congress, and also for the contribution of papers on agricultural subjects.

The subscriptions for members, who will receive the publications of the Congress gratuitously, and have the right of taking part in the discussions, has been fixed at 20 francs (16*s*.).

Subscriptions should be sent to the Secretary, British Committee (Mr. H. Chambers), Craven House, Northumberland Avenue, W.C., with whom those desirous of reading papers at the Congress should communicate.

Weekly Return of Market Prices.

The Weekly Return of Market Prices is now issued *free*, and may be obtained regularly upon application by farmers and others interested. This Return gives every week the prices of fat and store stock, dairy cattle, meat, corn, poultry, provisions, milk, hops, fruit, vegetables, wool, roots for cattle feeding, hay, and straw, at the chief representative markets in England and Wales. It is issued every Friday, and contains reports of markets up to the preceding Wednesday.

Farmers who desire to receive this return regularly should apply to "*The Secretary, Board of Agriculture and Fisheries, 3 St. James's Square, London, S.W.*" The envelope in which the application is enclosed need not be stamped.

Colonial and Foreign Statistics, 1911.

Part V. of the Agricultural Statistics, 1911, has been recently published by the Board (Cd. 6588, 1913, price 7½*d*.). This part comprises such returns as are available for 1911, and some previous years, of the acreage and production of crops, the number of live stock, and the prices of agricultural commodities in the British Empire and foreign countries, the particulars corresponding to those given in Part IV. of the Agricultural Statistics in previous years. The statistical tables are preceded by a report by Mr. R. H. Rew, which discusses the changes in the acreage, production, and prices of crops, and in the number and prices of live stock. The report contains an index to the whole of the Agricultural Statistics for 1911

MISCELLANEOUS NOTES.

Improvement of Mountain and Moorland Breeds of Ponies.

The Departmental Committee which was appointed by the President of the Board of Agriculture and Fisheries in February, 1912, to advise as to whether, and, if so, what measures can be adopted for the improvement of mountain and moorland breeds of ponies, has presented its Report (Wyman and Sons, price 6*d*.).

The Report contains an interesting account of the history and characteristics of the various mountain and moorland breeds of ponies, and establishes the fact that these ponies have had a share in the building up of our national breeds of light horses. The Committee are of opinion that the value of these ponies depends upon the open-air life and the wild conditions under which they have been kept for many generations, and that in order to preserve the purity of the breeds, and to improve and maintain their admirable qualities, the following measures should be adopted:—(1) Compulsory registration in recognised stud-books; (2) the institution and encouragement of a pony association in each district; and (3) the exercise of the Commons Act, 1908, for the elimination of the unfit animals.

The Committee consider that there is a great deficiency in the number of stallions in all the moorland districts, and they recommend that as many premiums as possible should be given to approved registered stallions to roam at large. They also recommend premiums to young mares until foaling, in the belief that the provision of annual premiums in successive years to the best fillies would ensure a constant influx of brood mares of the right stamp into the herds.

It is stated that the premiums to these mares could be awarded through the proposed pony associations, and that these associations should also direct their energies toward the elimination of unsuitable stock by means of encouraging stallions and mares of the type accepted as most suitable for the locality. A further duty of the pony associations would be to arrange for the interchange of stallions of recognised breeds, in order to minimise the disadvantages arising from the too close in-breeding of the herds.

The question of the advisability of stallions to travel in the districts bordering on the mountains and moorlands was carefully considered, and the Committee are unanimous in recommending that, if funds were available after providing for the mountain and moorland ponies, the Board should give assistance in this direction, which is much desired by many farmers and small-holders, by premiums for pony-bred cob stallions for the service of general utility pony mares.

The recommendations of the Committee with regard to the improvement of the individual breeds (in addition to the above-mentioned award of six premiums to fillies of each breed of ponies, subject to their appearance subsequently with foal at foot) were as follows:—

Dartmoor.—That amongst all the mountain and moorland breeds Dartmoor appears to require the most assistance, and that thirty premiums of £7 10*s*. each should be given annually for stallions, four years old and upwards, selected by district committees.

Exmoor.—That six premiums of £5 each should be given to stallions and six premiums to mares.

Fell.—The Committee recommend that the value of the six premiums awarded to Fell pony stallions should be increased from £20 to £25 each.

Highland.—The Board already award a limited number of premiums of the average value of £50 to Highland pony stallions, and they have made a grant to the Highland Committee of £400 for the purchase of Highland pony mares. The provisions of the scheme of the Board for Highland ponies appeared to the Committee to be both efficient and practical. The Committee, however, recommend the grant of nine premiums of £5 in respect of Highland pony stallions, which are turned out among mares during the season, and for which no provision has yet been made by the Board.

New Forest.—Under the scheme for light horse-breeding the Board award six premiums of £5 each to owners of New Forest pony stallions, and the Committee found that the scheme had worked admirably during 1912.

Welsh.—The Board already set aside the sum of £30 for the purpose of awarding four premiums of £5 each to owners of Welsh mountain pony stallions at Church Stretton, but the Committee recommend that the number should be increased to eight of £5 each, and that further premiums should be given as follows:—At Eppynt Forest, nine premiums of £5; at Gower Common, three premiums of £5; and at Penybont, three premiums of £5.

The Report discusses the questions of facilities for the carriage of animals, and the deterioration of pasturage, and also gives statistics as to the prices of animals of the various breeds.

Manual Instruction in Rural Elementary Schools.

The seventh Report of the Rural Education Conference (Cd. 6571, 1913, price 2½d.) has recently been published. It deals with a motion made by one of the members of the Conference as to (*a*) the possibility and advisability of introducing manual instruction throughout the whole of a child's school life into the rural elementary schools as a new method of teaching rather than as a new subject; and (*b*) whether a system of periodic, independent, individual examination of children in rural elementary schools should be initiated.

With regard to the first part of the reference, the Report states that by the term "manual instruction" is meant classes in such subjects as cookery, laundrywork, housewifery, dairywork, and gardening, for girls, and gardening, handicraft, and light woodwork for boys. The Conference are satisfied that whilst manual instruction has been introduced as a new method of teaching as distinguished from a new subject into a considerable number of schools under varying conditions, yet in the great bulk of the rural schools of the country very little if anything has been done in this direction. The Report says, however, that all the evidence received tended to prove beyond doubt that where this method of instruction has been introduced into rural schools by capable teachers who are in sympathy with it the result has been entirely beneficial. The children have acquired more initiative, have been able to express themselves more readily, and have shown increasing interest and intelligence in their work. The ordinary subjects taught have been more real to the children, and as a consequence the lessons have been more lasting owing to the fact that things in which they were interested in their daily life have been used as a means of teaching them. The development of the children's faculties has been helped by the fact that they have been given work to do which they have recognised as definitely useful, with the result that they have become more adaptable for their work in after life. Several witnesses laid stress upon the success with which the method has been employed in teaching children who have hitherto been considered to be dull or backward. The parents, too, have welcomed the method employed, and have become more interested in what their children have been taught.

The Conference accordingly recommend that County Education Authorities should do all they can to encourage the gradual introduction of the manual method of teaching into rural elementary schools—(*a*) by obtaining and spreading information as to the best examples that are to be found in various parts of the country; (*b*) by giving every encouragement and freedom to capable teachers who are willing to try the method; and (c) by providing classes for the training of teachers for this special purpose, or by giving facilities to teachers to attend such classes as already exist. In view of the national importance of the matter, it is recommended that the Board of Education should use its best endeavours to encourage Local Authorities to promote the extension of this system, and that increased grants should be provided from the Exchequer to encourage Local Authorities to incur the expense of the necessary equipment and of employing a larger number of suitable teachers. This is especially necessary in the case of rural districts with a scattered population and a low rateable value. The Report points out, however, that too much importance should not be attached in the first instance to the provision of special accommodation and equipment for this particular method of teaching.

With regard to the second part of the reference, the Conference report that the abolition of the old system of examination has led, in some areas, to slackness on the part of some teachers and the consequent lowering of the standard of teaching in certain schools, and they suggest that the inspection by the Board of Education might be more complete, and that the results of such inspections might be more systematically and freely communicated to the local education authorities. Interesting summaries of the evidence received on both parts of the reference are published in the appendix to the Report.

Importation Regulations.

Importation of Lucerne and Forage Plant Seed into Argentina.—A Presidential Decree of November 28th, 1912, prohibits the importation into Argentina of alfalfa (lucerne) seed, which has not a germination capacity equivalent to 60 per cent. of its bulk. It appears that alfalfa seed has sometimes been imported into the Republic with a germination capacity of only 20 per cent. of the seed.

An earlier Decree of November 30th, 1911, prohibited the importation of lucerne and other forage plant seed containing more than twenty grammes of "dodder" to the kilogramme weight of seed. The importation of trefoil seed (*Medicago denticulata*) was forbidden by this latter Decree.

Importation of Cattle into Australia.—With the view of preventing the introduction of *Hypoderma bovis* into Australia, a Proclamation of October 23rd, 1912, under the Quarantine Act, 1908, prohibits the importation of cattle into Australia from the United Kingdom, except those shipped during each of the months from October to May inclusive.

Importation of Animals into the Straits Settlements.—A notice of November 4th last, under the Straits Settlements Quarantine Rules of 1908, provides that "every animal brought to the Colony shall undergo an examination by the Veterinary Officer, and no animal shall be landed from any ship or removed from any station without his permission. Such examination may be made at such convenient place as the Veterinary Officer shall appoint, and it shall be lawful for the Veterinary Officer to detain at such place any animal for observation for a period not exceeding ten days from the time of arrival of such animal." (*Board of Trade Journal,* January 9th, 1913.)

Notes on Agriculture Abroad.

State Aid to Agriculture in Austria.—A fund, which provides a sum of £250,000 yearly for the development of the animal breeding industry in Austria in the years 1910–18, was established by a law of December 30th, 1910. According to the report of the Austrian Ministry of Agriculture on the administration of the fund in 1911, £42,000 was allocated to the sale of live stock, while £208,000 was granted in aid of the promotion of animal breeding and to the improvement of live stock. This latter sum was distributed among the various provinces of the empire in proportion to the number of cattle in each as determined by a census taken on December 31st, 1900. The whole of the £250,000 was not spent in either 1910 or 1911. The total amount unspent, including interest, reached the sum of £170,000 at the end of 1911.

Improvement of Live Stock.—Of the total sum provided annually for the animal breeding industry, £83,000 was allocated in 1911 to animal breeding proper, of which, however, only about £57,000 was actually spent. First-class bulls and good cows were purchased, subventions were granted to cattle breeding centres, efforts were made to establish herd books, and premiums were granted to stockmen whose animals were well fed and cared for. With a view to saving calves from the butcher, provision was made from the fund in respect of premiums for calves and the formation of breeding centres for calves in those districts of the empire, where such a course was considered necessary. Included in this part of the scheme is the encouragement of the growth of fodder crops.

Improvement of Pasture.—An important part of the scheme is the improvement of poor pasture. The sum of approximately £46,000 was allocated to this purpose in 1911 (£23,000 being the amount actually spent), principally in the Alpine and Carpathian districts. In the three provinces of Upper Austria, Salzburg, and Kärnten, provision was made for the improvement of moor and heath land, a further sum of £1,300 being granted for this purpose (£400 being actually spent).

Dairying.—The sum of £15,000 granted to the dairy industry in 1911 (the amount actually spent was £9,000) was devoted to the provision of dairy experts to advise as to the maintenance of dairy herds, the production and handling of milk, and the manufacture of dairy produce; the holding of dairying courses; arrangements for the visits of agriculturists to dairy schools and model dairies; and the publication of dairying journals. In some cases also assistance was given to co-operative associations of dairy farmers.

Purchase of Fertilisers and Feeding Stuffs.—Co-operative associations having as their object the purchase of fertilisers and feeding stuffs were subsidised to the extent of £5,300 in 1911.

Live Stock Insurance.—The sum of £25,000 was spent in 1911 in the promotion of animal insurance among agriculturists. The procedure has been to subsidise agricultural insurance institutions formed by the diets of several of the Austrian provinces, which have as their object the division of the country into insurance districts, and which aim at making each of the local societies self-dependent. The problem of the organisation of live stock insurance appears to have been most happily solved in the Tyrol, where the independent local societies are themselves insured with an agricultural re-insuring institution. As a result of poor harvests of fodder crops, the prevalence of animal disease, and the lack of any substantial reserve funds, the institutions have had great difficulty in carrying on their work. The Ministry of Agriculture have, therefore, granted £4,000 a year for five years to the institutions in Lower Austria, and have so far given £1,300 a year to the institutions in Upper Austria, £2,000 to those in Mähren, £2,000 to the institution in Tyrol, £600 to that in Kärnten, and £130 to that in Istria. These sums have been granted, however, only on the understanding that they are to be applied to the insurance of cattle. In those provinces in which the organisation of the arrangements for insurance have not been completed various sums are laid by yearly from which the institutions will be aided when they are in working order; as much as £6,000 a year is being laid by for this purpose for the province of Galicia. Two provinces have resolved not to found these central institutions, and the Ministry of Agriculture have therefore been compelled to aid the local societies directly.

Sale of Live Stock.—An account of the organisation of the sale of live stock in Austria was given in this Journal for November, 1912, p. 691.

Forestry Congress at Paris in 1913.—An international forestry congress will be held in Paris from June 16th to 20th, 1913, under the auspices of the Touring Club de France. The programme is divided into five sections, *viz.:* (1) sylviculture; (2) forest economics and forest laws; (3) forest technology, including the conversion, uses, and preservation of timber, other forest by-products, &c.; (4) reclamation and improvement of waste lands by afforestation or similar means; and (5) the value of the forest in developing touring and an appreciation of rural æsthetics.

A copy of the programme and rules of the Congress (in French) may be seen at the office of the Board of Agriculture, 4 Whitehall Place, London, S.W.

Adriatic Exhibition in Vienna in 1913.—The Board have been informed through the Foreign Office that an "Adriatic Exhibition" will be held in Vienna in the course of the year 1913 in the well-known Rotunda which serves as an Exhibition Palace. The Exhibition is being subsidised by the Austrian Government and the municipality of Vienna. It is designed to represent the development of civilisation in the regions bordering on the Adriatic, and there will be sections illustrative of the agricultural, horticultural, and forestry resources of the region bordering on the Austrian Adriatic coast. Foreign exhibitors will be admitted to some of the sections in which foreign countries are interested.

International Horticultural Exhibition at St. Petersburg.—With reference to the notice as to the Exhibition which appeared in the *Journal* for October, 1912, p. 587, the Board are now informed that the opening of the Exhibition has been postponed until the spring of 1914.

Cost of Harvesting in France.—The following particulars of the cost of harvesting on a farm of 286 acres, of which 175 acres were under wheat and 111 acres under oats, were given in a paper read before the National Society of Agriculture of France. Reaping by hand and by machine lasted twenty days (from July 18th to August 6th). The crop was got in in nine days (August 4th to August 12th).

Cost of Harvesting by Hand.—The harvesters did 124 days of work on 64 acres, each cutting and binding about ½ acre per day. They earned £40 15*s.*, or 6*s.* 6*d.* per day. The total cost of harvesting and binding by hand was £48 5*s.* 9*d.*, or 15*s.* 1*d.* per acre.

Cost of Harvesting by Machinery.—Three self-binders and one reaper were used to cut 222 acres. They cut on the average 6 acres a day, each clearing about 52 acres, and occupying altogether 45¾ man-days', 89¾ horse-days', and 37 ox-days' labour. The items in the cost were as follows:—

	£	*s.*	*d*
Cost of opening up the field with the scythe	6	11	0
Wages of machine drivers (45¾ man-days)	6	7	2
Premium for work done, 4*d.* per acre	3	11	6
Binding the scythe work, picking up the sheaves behind the self-binding machine, binding behind the reaper	15	11	10
Cost of horse labour (89¾ horse-days' work at 3*s.* 7*d.* per day)	16	0	8
Cost of ox labour (37 ox-days' work at 1*s.* 7½*d.* per day)	3	0	2
Oil, upkeep and depreciation of 4 machines	31	15	0
Cost of twine, 5½ lb. per acre...	18	16	4
Total	101	13	8
Or per acre	0	9	2

The cost of carrying was £210, or 14*s.* 8*d.* per acre over the 286 acres, viz.:—

	£	*s.*	*d.*
Cost of labour—19 labourers, foremen and bailiff, 10 days at about 7*s.* 3*d.* per man per day	77	0	4
Cost of horse labour, 117¾ horse-days at 3*s.* 7*d.*	23	17	11
Cost of ox labour, 87 ox-days at 1*s.* 7½*d.*	8	10	9
Other expenses:—			
Thatching 3 stacks...	2	13	6
Straw	4	3	3
String and stakes	1	4	0
Redemption of £913 paid for sheds in 20 years	40	13	0
Interest on balance remaining to be redeemed at 5 per cent.	42	16	6
Sundries	4	0	0
Total	£209	19	3

The total cost of harvesting by hand, harvesting by machinery, and carrying was thus £360, or 25*s.* per acre. It must be mentioned, however, that the work was carried out without interruption in exceptionally good weather. (*Journal d'Agriculture Pratique*, July 4th, 1912.)

Notes on the Weather in January.

The weather during the *first* week of the year (December 29th to January 4th) was very unsettled. Rain was experienced almost daily in the south-west of England and in the north of Scotland, and on several days over the country as a whole. In some districts, however, fair intervals were commoner than during the few preceding weeks. Warmth was everywhere "unusual," the excess of temperature above the average amounting to as much as 6° in England E. Rainfall was "heavy" in Scotland N. and W., and England N.W., S.W., and the Midland Counties; "moderate" in Scotland E., England N.E., and England S.E., and "light" in England E. Bright sunshine was below the normal generally, but exceeded it in England E. and S.E.

During the *second* week the weather over a large part of England was often fair and occasionally fine and bright. Temperature continued above the average. Rainfall was in excess of the average except in Scotland N., and in most districts the excess was very large. Bright sunshine was "scanty," except in three districts, viz., Scotland N., England S.E., and England N.W., where it was moderate.

The weather continued unsettled in the *third* week, but fair, dry intervals were not uncommon in most parts of England and Ireland. A good deal of snow was experienced over the northern districts early in the week. Temperature was everywhere below the average. Rainfall was "light" in Scotland N. and the Midland Counties, "heavy" in England E., S.E., and S.W., and "moderate" elsewhere. Bright sunshine exceeded the normal except in England N.E. and over Scotland.

The general conditions remained very unsettled in the *fourth* week. Over the northern districts snow or sleet was of frequent occurrence. Temperature was again below the average in Scotland, and the north of England, but above it elsewhere. Rainfall was above the normal, except in Scotland N., the excess being very considerable generally. Except in Scotland N. and W., bright sunshine was either "scanty" or "very scanty."

In the *fifth* week the weather commenced fair to bright in most parts of the country, but the subsequent conditions were changeable, with rather frequent rain. Temperature was slightly above the average in England E. and S.E., but below it elsewhere. Rainfall was everywhere in excess of the average. Bright sunshine was "moderate" in England E., N.E., and N.W., but in other places it was "scanty" or "very scanty."

Agricultural Conditions in England and Wales during January.

The Crop Reporters of the Board state that the wet weather which very generally prevailed over the whole of England and Wales during January considerably interfered with farm work. Low-lying and heavy lands are everywhere sodden, while in the midlands and north there were some heavy falls of snow. Wheat is generally healthy and promising on the light and drier lands, but on low ground it is suffering from the wet, and is often weak and turning yellow. Where healthy, it is in many parts considered to be too forward for the season. Generally speaking, the early sown wheat is better than that sown late. Seeds are very flourishing. Very little preparation of the land for the spring crops has been done, except on the lightest soils, and such field-work is in most districts considerably in arrear.

In the earlier districts, lambing is progressing not unfavourably on the whole. The Dorset Horn flocks have mostly finished lambing, and in their case the results are hardly satisfactory; the fall is generally reported to be below average, as the proportion of twins is small, but, on the other hand, there are fewer losses of ewes than last year. Further west there have been serious losses among ewes from liver fluke. Among other flocks which have already lambed, the fall is more nearly average. Ewes are, especially on low land, only in fair condition. In the Midlands and North, where lambing has not commenced, ewes are generally in fair condition, and prospects are satisfactory, but would be much better with drier weather.

Stock generally are in fair condition, although the weather has been very trying. There has been plenty of grass in the pastures, and roots—where not already consumed—have often made further growth, so that keep is generally sufficient, and the month has brought improvement in this respect. Hay and straw are everywhere of poor quality. Serious losses of sheep from liver-fluke are reported in the west and south-west, while elsewhere there is occasional mention of foot-rot.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for January, 1913, issued by the International Institute of Agriculture, gives the final returns of the production of the cereal crops last year in Norway, Russia, Canada, United States, Japan, and Egypt, and contains for the first time an estimate of the production in Sweden in 1912. Estimates are also given of the acreage sown with winter cereals in several countries of the northern hemisphere.

Norway.—The production of wheat in 1912 amounted to 38,000 qr., an increase on 1911 of 11·9 per cent. Rye was 8·6 per cent. below 1911, the production being 101,000 qr. Barley and oats both showed larger productions than in 1911, the former totalling 368,000 qr., or an increase of 14·3 per cent., and the latter 1,138,000 qr., or 8·9 per cent. more than in 1911.

Russia.—Definite figures for the harvest of winter cereals are available, and by adding to these the preliminary figures for the harvest of spring cereals, the total production of wheat in 1912 in the 63 governments in Europe is shown to have amounted to 77,918,000 qr., or 39·5 per cent. more than in 1911; of rye to 117,940,000 qr., an increase of 36·2 per cent.; and of barley to 54,656,000 qr., or 12·7 per cent. more than in 1911.

Canada.—The definite results of the cereal harvests in 1912 place the production of wheat at 24,898,000 qr., or 7·7 per cent. less than in

1911. Rye was also less by 2·8 per cent., the production being 303,000 qr. Barley amounted to 5,280,000 qr., an increase of 8·3 per cent., and oats to 39,408,000 qr., or 3·8 per cent. above 1911. The production of maize was 1,933,000 qr., a reduction of 11·7 per cent.

United States.—The production of each of the five crops—wheat, rye, barley, oats, and maize—in 1912 was greater than in 1911. The wheat crop of 91,259,000 qr. was 17·5 per cent. greater; rye, 4,160,000 qr., 7·7 per cent. greater; barley, 26,851,000 qr., 39·7 per cent. greater; oats, 145,430,000 qr., 53·8 per cent. greater; and maize, 364,448,000 qr., 23·4 per cent. greater than in 1911.

Japan.—The final figures of the wheat and barley harvests in 1911–12 give the production of wheat as 3,211,000 qr., or 3·4 per cent. more than the previous year, and of barley as 11,946,000 qr., or an increase of 4·8 per cent.

Egypt.—The production of wheat in 1912 amounted to 3,861,000 qr., or 18·8 per cent., less than in 1911. Barley was also less by 3·2 per cent., but maize showed an increase of 8·5 per cent., the production of barley being 1,360,000 qr., and of maize 8,589,000 qr.

Sweden.—The most recent figures for the production in 1912 are as follows:—Wheat, 974,000 qr.; rye, 2,691,000 qr.; barley, 1,698,000 qr.; and oats, 8,999,000 qr. Wheat, rye, and barley are all less than in 1911 by 5·3, 6·5, and 3·7 per cent. respectively, but oats is greater by 15·5 per cent.

Sowing of Winter Cereals.—The areas estimated to have been sown to *wheat* up to December 31st, 1912, compared with the areas sown during the corresponding period of 1911, expressed as percentages, are as follows:—Belgium, 97; Denmark, 100; Spain, 93; England and Wales, 95; Luxemburg, 100; Switzerland, 100; Canada, 94; United States, 97; India, 102; Japan, 100; and Tunis, 100. The areas sown to *rye* are:—Belgium, Denmark, and Switzerland, 100; Spain, 91; Luxemburg, 99; and United States, 99. The areas sown to *barley* are:—Belgium, 94; Spain, 98; Luxemburg, 135; Switzerland, 100; and Tunis, 100; and to *oats,* Spain, 83, and Tunis, 100.

The following information is given concerning crops in the southern hemisphere:—

Wheat.—The estimated total production in Argentina, Australia, and New Zealand in 1912–13 amounts to 40,173,000 qr., as compared with 30,737,000 qr. in 1911–12, the increase being equal to 30·7 per cent. The area planted was 0·4 per cent. more than in 1911–12. An estimate is given for New Zealand for the first time, and places the production at 904,000 qr., which is 8·5 per cent. below that of the previous year.

Oats.—The total production in Argentina and New Zealand is estimated at 13,693,000 qr., against 9,549,000 qr. in 1911–12, or an increase of 43·4 per cent. The area under production shows an increase equal to 13·0 per cent. The estimated production in New Zealand is 1,811,000 qr., or 26·3 per cent. less than in 1911–12.

Barley.—The production of barley in New Zealand is placed at 142,000 qr., which shows a reduction on the previous year of 9·2 per cent.

Sugar Beet.—The estimated production in the Kingdom of Hungary in 1912 is 4,759,000 tons, or an increase on 1911 of 140·6 per cent.

The estimate for Russia in Europe has undergone a considerable diminution, frost having destroyed a considerable quantity of the crop. The production is now estimated at 8,815,000 tons.

Norway.—The official returns place the yield of wheat in 1912 at 38,977 qr., or 4 per cent. above the average; that of barley at 362,521 qr., or 3 per cent. above; that of oats at 1,363,453 qr., or 9 per cent. above; that of rye at 122,408 qr., or 2 per cent. below; and that of peas at 29,230 qr., also 2 per cent. below the average. The yields of potatoes (722,582 tons) and hay (3,129,768 tons) were both 11 per cent. above the average, while the yield of straw (597,631 tons) was 6 per cent. above. The quality of straw and winter seed and of hay in some cases was not very good, but that of the other crops varied from good to very good. (H.M. Consul at Christiania, January 14th.)

Italy.—According to the official report from January 10th to 20th, a light covering of snow in most districts in the north was beneficial to the crops. In Tuscany, the Abruzzi, and the southern Mediterranean districts, however, the excessive moisture and the mild weather were unfavourable to their normal development. On the whole the grain crop prospects were satisfactory, and the meadows looked well. (*Dornbusch,* February 3rd.)

India.—The first General Memorandum on the wheat crop of 1912–13 issued by the Commercial Intelligence Department of India on January 2nd states that, excluding the returns of a number of native states which usually contain some 14 per cent. of the total wheat acreage, the area sown, at the date of the Memorandum, in the remaining territory was about 24,634,000 acres, as compared with 24,031,000 acres at the same date last year, an increase of 2·5 per cent. The sowing season has, on the whole, been fairly favourable, and the condition of the crop is reported to be generally from fair to good, but rain was wanted in many places in western and north-western India.

Russia.—H.M. Consul-General at Odessa, under date February 1st, reporting on crop prospects in South Russia, states that the recent severe frosts, unaccompanied by an equally widespread snowfall, will, it is feared, have done considerable harm to the winter crops. As, however, only a small part of the usual area was sown last autumn in South Russia, the failure of winter wheat would be a less severe blow to farmers than under normal conditions. The prospects for spring sowings are, on the other hand, most favourable.

France.—The areas under winter cereals were officially estimated on January 1st as follows:—Wheat, 15,561,500 acres, compared with 15,595,800 acres at the same date in 1912; barley, 380,600 acres, compared with 400,900 acres; oats, 2,036,000 acres, compared with 1,979,200 acres; and rye, 2,855,200 acres, compared with 3,020,600 acres in 1912. The condition of wheat and rye was placed at 71, and that of barley and oats at 73 (100=very good, 80=good, 60=fairly good).

Hops.—The produce of the hop crop in Germany in 1912 is officially estimated at 404,660 cwt., compared with 209,138 cwt. in 1911. The yields per acre were 6·1 and 3·2 cwt. respectively. (*Deutscher Reichsanzeiger.*)

Meat Supplies at Chicago.—H.M. Consul-General at Chicago, in a report dated January 9th, states that the number of cattle received for packing purposes during 1912 was 1,681,136, compared with 1,715,279 in 1911; of calves 482,932, compared with 493,561; of swine 5,998,782, compared with 5,929,585; and of sheep 4,880,873, compared with 4,452,821. The total of all kinds was 13,043,723 in 1912, and 12,591,246 in 1911.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on February 1st, 1913, certain diseases of animals existed in the countries specified:—

Austria (for the period January 15th—22nd).
Anthrax, Blackleg, Foot-and-Mouth Disease (total of 95 Höfe now infected), Glanders and Farcy, Rabies, Sheep-Scab, Swine Erysipelas, Swine Fever.

Belgium (for the period December 1st—15th).
Anthrax, Blackleg, Foot-and-Mouth Disease (1 outbreak), Rabies, Sheep-scab.

Bulgaria (for the period September 14th—21st).
Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Swine Fever.

Denmark (month of December).
Anthrax, Foot-and-Mouth Disease (1 outbreak), Swine Erysipelas.

France (for the period January 5th—11th).
Anthrax, Blackleg, Foot-and-Mouth Disease (224 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period December 15th—31st).
Foot-and-Mouth Disease (92 infected places in 45 parishes), Glanders and Farcy, Swine Fever.

Holland (month of December).
Anthrax, Foot-and-Mouth Disease (6 outbreaks in 3 provinces), Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (for the period January 8th—15th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 10 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period December 23rd—29th).
Anthrax, Foot-and-Mouth Disease (1793 new cases entailing 23,930 animals), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period June 15th—July 1st).
Glanders and Farcy.

Norway (month of December).
Anthrax, Blackleg.

Rumania (for the period December 29th—January 5th).
Anthrax, Dourine, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of September).
Anthrax, Foot-and-Mouth Disease (19,502 animals in 204 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period September 14th—21st).
Sheep-pox, Swine Fever.

Spain (month of November).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (595 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of December).
Anthrax, Blackleg.

Switzerland (for the period January 13th—19th).
Anthrax, Blackleg, Foot-and-Mouth Disease (217 "étables" entailing 2604 animals, of which 29 "étables" were declared infected during the period), Swine Fever.

Agricultural Labour in England during January.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in January:—

Rain and snow caused a good deal of lost time for labourers outside the regular farm staff in January, the time lost usually varying from about 4 to 10 days, while in a number of districts in the Southern and South-Western Counties as much as half the month was lost on account of wet weather. In a few districts where farm-work was backward, the demand for extra labourers was fair for the time of the year, but usually it was only moderate, being considerably reduced in many districts where the wet state of the land rendered it unfit to work on. The principal kinds of work for which extra men were wanted were threshing, hedging and ditching, fencing, draining, carting and spreading manure. The supply of and demand for such men were about equal in most districts when the weather was fine, but some surplus of men was reported in parts of the Scarborough and Wath (*Yorkshire*), Stratford-on-Avon (*Warwickshire*), Crowmarsh (*Oxfordshire*), Chesterton and Wisbech (*Cambridgeshire*), Bourne (*Lincolnshire*), Epsom and Guildford (*Surrey*), Highworth-and-Swindon (*Wiltshire*), Blandford (*Dorset*), and Tavistock (*Devonshire*) Rural Districts; while there was an insufficient supply in the Stockton (*Durham*), Melton Mowbray (*Leicestershire*), Evesham (*Worcestershire*), Monks Kirby and Rugby (*Warwickshire*), Buckingham, Eaton Socon (*Bedfordshire*), Samford (*Suffolk*), Pewsey (*Wiltshire*), Dursley (*Gloucestershire*), and Newton Abbot (*Devonshire*) Rural Districts. Some scarcity of men for permanent situations was reported in the Brinworth and Wellingborough (*Northamptonshire*), Wangford (*Suffolk*), Chailey and Petworth (*Sussex*), Pewsey (*Wiltshire*), Williton (*Somerset*), Cirencester, Dursley, and Stow-on-the-Wold (*Gloucestershire*), and Newton Abbot (*Devonshire*) Rural Districts.

THE CORN MARKETS IN JANUARY.

C. KAINS-JACKSON.

Wheat.—With January repeating December's weather record of over average temperature and rainfall, the wheat trade was robbed of the support which it usually derives from midwinter conditions. The degree to which the actual consumption of bread is reduced by a mild winter is a matter of dispute, but the effect on the purchases of flour by bakers is undoubted. Flour is not a first-rate keeping article, and bakers dislike being stocked much ahead of actual wants for use. This state of things quickly reacts on wheat, which but for one circumstance would probably have sustained a greater decline than the sixpence net loss to holders of foreign which had in the end to be recorded. The shippers from the great producing lands were not on the whole an eager body, and those who did press sales with some eagerness, the Argentine exporters, secured very few contracts for England owing to their refusal to sell on what the Corn Trade Associations of the Thames, the Mersey, the Clyde, and the Humber were agreed in requiring as an adequate sample. From the present month of February, however, this impediment to contracts will disappear, the Argentine shippers having now accepted the main requirement of the British buyer.

The actual January shipments were 2,120,000 qr. from North America, 659,000 qr. from South America, 535,000 qr. from Russia, 372,000 qr. from Europe S.E., and 374,000 qr. from Australasia. The state of the trade as the month closed corresponded closely with these figures, North American wheat being more depressed than the other kinds, while Russian, Roumanian, and Indian sorts were quite firm. The Australian new crop has been slow in getting into motion, as may be seen from shipments for the three preceding Januaries, which were respectively 583,000 qr., 726,000 qr., and 943,000 qr. The trade, however, is not misled by this delay. The crop to be drawn upon is accepted as being about 10 per cent. larger than that of a year ago. Supplies on passage at the end of the month were 2,010,000 qr., which is 365,000 qr. less than at this date last year, and affords a fair measure of the slower rate of exports from the regions of production.

As compared with a year ago the sources whence prospective supply has increased are North America and Argentina, while anticipations from India, Australia, and Europe S.E. are reduced. The great railway strike in Argentina in January, 1912, resulted in grain being held up, but the markets in England were not helped, the produce was bought, and only awaited export until the strike clause safeguarding the seller ceased with the cessation of the strike. The month closed at Mark Lane with Canadian at 30*s.* to 39*s.*, Northern Spring at 37*s.* to 37*s.* 6*d.*, Red Winter at 36*s.* to 36*s.* 6*d.*, fine Russian at 36*s.* to 37*s.*, and Indian at 38*s.* to 38*s.* 6*d.* At Liverpool closing prices per cental were:—No. 3 Canadian, 7*s.* 5*d.*; New Argentine, 7*s.* 4*d.* (scarce); No. 1 Duluth, 7*s.* 7*d.*; ordinary Russian, 7*s.* 5*d.*; and old Australian, 8*s.* 2*d.* These quotations do not look like any net decline on the month, but there has been a large quantity of wheat below the good grades pressed on sale at a loss, and it is rumoured that to buyers on a large scale specially reduced prices have been often allowed, though market quotations have been nominally kept up. In the absence of official averages this state of affairs is liable to result with every recurrence of dull and difficult markets. Where official prices are available, as for home produce, January is found to have been characterised by surface fluctuations merely. Some very low averages have been recorded from the Fen Country, and also from Yorkshire, and the latter county seems to have suffered most severely from the cold, wet, and windy harvest. But these prices have been balanced by 32*s.* to 33*s.* averages in less unfortunate districts, especially in Suffolk, Essex, and Kent. Some very fair wheat has been reaching Mark Lane of late from both Essex and Suffolk. Threshings during January were smaller than usual, as the weather was persistently adverse. Farmers, having sold so much less wheat this season, have now nearly average stocks, despite the smaller harvest out-turn. At the end of the month stocks in the fifteen chief ports were 1,970,000 qr., against 1,705,000 qr. a year previously.

Flour.—The pressure of London flour on sale has ceased, and London millers, having arranged for the carrying over of such stocks as were in weak hands, were able on the 20th to put up prices for credit and delivery to 29*s.* 6*d.* Households, 32*s.* 6*d.* Town Whites. These terms represent 28*s.* and 31*s.* ex mill for cash. There have been excessive offers of inferior country flour at 23*s.* to 24*s.*, a poor and depressing price, but Roller Whites closed firm at 25*s.*, and for good firms' trusted mixtures, in which the weak English is strengthened by dry, hard foreign, 1*s.* 6*d.* over that quotation was making. Other prices with which the month closed were Hungarian, 38*s.*; Top Price, 33*s.*; Goliath, 30*s.*; Pillsbury's Best, 28*s.*; Minnesota Patents, 27*s.* 6*d.*; Manitoba Patents, 27*s.*; Kansas Winter Wheat Flour, 26*s.*; and fine French, from the famed Corbeil Mills, 31*s.*, all per sack of 280 lb. The markets for by-products of the mill has hardened a little in the course of the month. North American shipments were a little over half a million sacks, and 254,000 sacks were on passage on the 31st.

Barley.—There has been a very encouraging demand for seed corn, and up to 48*s.* has been paid for special Archer and Chevallier, and 46*s.* for Goldthorpe. Maltsters have bought less than usual, as they do not like damp and mild weather for their business, but they have paid well over 40*s.* for anything of good colour. The type which is more than another characteristic of this season is a fairly robust grain, weighing 448 lb., but stained and of poor colour naturally. This sort fetches 32*s.* to 34*s.* at the leading markets. Feeding barley at Mark Lane has made 30*s.* for 416-lb. lots, and 27*s.* to 28*s.* for 400-lb. descriptions. Imported barley has come in at 26*s.* 6*d.* for Persian, 27*s.* for Russian, 28*s.* for Indian, 32*s.* for Moroccan, 39*s.* for Oregon, 40*s.* for Californian, and 43*s.* for screened Anatolian. The market has appreciated for Russian and Anatolian, but is easier for Californian. Shipments of the month were 145,000 qr. from India, 442,000 qr. from North America, 852,000 qr. from Russia, and 15,000 qr. from Anatolia. Supplies on passage, 620,000 qr., consist of 405,000 qr. brewing grade, but only 200,000 qr. for feeding use.

Oats.—The average price of British oats continues to be fairly well maintained, and the mean price for the cereal year to date is very little under a sovereign per quarter. The markets have not lacked fair supply of good quality and excellent natural weight. This crop was much below an average yield in certain counties, but it suffered less than either wheat or barley in regard to condition. Some disastrously low averages continue to be recorded from the Fens; but, on the other hand, prices like 23*s.* 2*d.* at Bury St. Edmunds, 22*s.* 7*d.* at Canterbury, and even less noticeable averages, like 20*s.* 11*d.* at Lincoln and 22*s.* 9*d.* at Chelmsford, witness to a good deal of produce of natural good quality being saved in at least a fair state. Imports of oats have been below the average, so that the price of Canadian, American, and Russian sorts have slightly appreciated. Argentina's anxiety to sell her new crop prevents this improved feeling extending to the grain on passage from the River Plate. January shipments were 244,000 qr. from North America, 735,000 qr. from South America, 752,000 qr. from Russia, and 5,000 qr. from New Zealand. There are now 365,000 qr. on passage, mainly from North and South America.

Maize.—The new crop in America began to reach the coast about Christmas, and was being shipped with some freedom a fortnight later. On the whole, however, there has not been any great anxiety to ship. A few thousand quarters have already reached our shores by the faster steamers, but at Liverpool on the 28th, Mark Lane on the 29th, and Manchester on the 30th, the demand was dulled by a certain want of dry condition. Later shipments will presumably be more satisfactory. The prices asked for delivery a month after date of contract have fallen to 4*s.* 11*d.* per cental on our port markets. This is 2*d.* decline on the month, but closing spot prices at Liverpool were 5*s.* 5*d.* for new American, 5*s.* 3*d.* for Argentine, 5*s.* 5*d.* for West African, 5*s.* 9*d.* for Odessa, 5*s.* 5*d.* for Novorossisk, and 6*s.* 6*d.* for Galatz Cinquantina. There were 825,000 qr. on passage on the 31st, against 345,000 qr. a year previously, and this naturally made the forward market weak. The month's shipments were 832,000 qr. from North America, 1,349,000 qr. from South America, and the very small total of 45,000 qr. from the countries shipping round corn.

Oilseeds.—Not for some years has linseed been so cheap as during the past month. A large business has been done at 44*s.* to 45*s.* per 416 lb. for Argentine, 45*s.* to 46*s.* per 416 lb. for American, 46*s.* to 47*s.* per 416 lb. for Canadian, and 50*s.* to 51*s.* per 410 lb. for Indian. The cheapness of linseed has caused a decline in linseed cake, which comes as a boon to farmers with stock to fatten and young lambs to bring on. For good Egyptian cottonseed 9*s.* per cwt. has remained the regular quotation.

Various.—The cheapness of beet-sugar greatly favours the production of various proprietary "fatteners" at attractively moderate prices. For pulse the trade during January was very fair, and demand was as usual, far better for the sorts that split well than those which do not. Argentine millet and Syrian dari were scarce, and the war caused a high price to be quoted for Turkish canaryseed.

THE LIVE AND DEAD MEAT TRADE IN JANUARY.

A. T. MATTHEWS.

Fat Cattle.—Experienced observers are agreed that movements in the meat trade are always more or less affected by the weather, and atmospheric conditions during January were depressing to an unusual degree. Taking this fact into consideration, sellers have little to complain of, since average prices have been more than maintained compared with those of December, when the Christmas demand is supposed to have some influence. Supplies have been considerably below the average of the last three years, owing—at least in part—to the restrictions on Irish cattle; and at the Metropolitan market in particular the Polled Irish Shorthorns from Norfolk, which usually form such a striking feature at this season, have been sadly missed. There was also an almost entire absence of cattle from Scotland, traceable to the same cause.

The following are the average prices obtained for the various breeds in over twenty leading English markets:—Shorthorns, for first and second quality, 8*s.* 11*d.* and 8*s.* 2*d.* per 14 lb. stone, against 8*s.* 10*d.* and 8*s.* 1*d.* in December; Herefords, 9*s.* and 8*s.* 6*d.*, against 8*s.* 11*d.* and 8*s.* 3*d.*; Devons, 8*s.* 11*d.* and 8*s.* 1*d.*, against 8*s.* 11*d.* and 8*s.*; Welsh Runts, 9*s.* and 8*s.* 3*d.*, against 8*s.* 9*d.* and 8*s.* 1*d.*; and Polled Scots, 9*s.* 3*d.* and 8*s.* 5*d.*, against 9*s.* 3*d.* and 8*s.* 6*d.* In the last week the trade showed a rather decided weakening tendency. The demand for fat cows has been very good, and the increasing business at Islington for export to the Continent has drawn much larger numbers of that class of cattle to London, including some good Devons from Devonshire. Notwithstanding the increased supplies which have thus been attracted, prices for fat bulls and cows were slightly better than in December.

Veal Calves.—The production of veal at this time of year is naturally restricted, as is also the demand, consumers generally regarding it as out of season. Average prices advanced in January by ½*d.* per lb., and were 9½*d.* and 8½*d.* in leading English markets.

Fat Sheep.—The diminution in the supplies of fat sheep in English markets during January points to a decided shortage in the country. In three weeks the total decrease, compared with the three years' average, was no less than 26,209, and it is therefore not surprising that prices have advanced by about ½*d.* per lb. over those of December. They have not, so far, reached those of the middle of April last year, when the average for Downs touched 10¼*d.* per lb. In the last week "Cross-breds" in English markets averaged 10*d.* per lb., a fraction more than those classed as "Downs." At Hull and Penrith they fetched 10¾*d.* per lb., and were probably a cross between the Blackfaced Mountain and Border Leicester, but the sensation of the month was at Penrith, where, for two weeks in succession, Cheviots have realised 1*s.* per lb., while this breed has averaged 11*d.* in English markets during the last week. Downs in twenty-three markets averaged 9¾*d.*, 8¾*d.*, and 7*d.*, against 9¼*d.*, 8¼*d.*, and 6½*d.* in December, and Longwools 9⅛*d.*, 8¼*d.*, and 6¾*d.*, against 8⅛*d.*, 7¾*d.*, and 6¼*d.* The latter are high prices for Longwools in proportion to those for Downs, but the improved price of wool is helping their sale.

The Belgian trade for cattle has now extended to sheep, and considerable numbers of fat ewes were purchased at Islington in the last fortnight for export. This accounts for the sharp advance in the price of ewes, which has amounted to about 1*d.* per lb. during the month, bringing their value at Islington to 7¼*d.* per lb.

Fat Pigs.—The trade in bacon pigs has remained extremely firm, the averages for the month being 8*s.* 1*d.* and 7*s.* 7*d.* for first and second quality. One effect of the high price of bacon pigs is a very keen demand for stores.

Carcass Beef—British.—Scotch beef has met a singularly quiet, dull trade all the month, and since the first week quotations have been steady at 4*s.* 8*d.* to 4*s.* 10*d.* for short sides, and 4*s.* 4*d.* to 4*s.* 6*d.* per 8 lb. for long sides, or a fall of 2*d.* from the figures of the first week, the average being practically the same as in December. English sides have made only ½*d.* per stone less than Scotch. Irish (Birkenhead-killed) averaged 3*s.* 10*d.* to 4*s.* 2*d.* per stone.

Chilled Beef.—Argentine chilled beef was in much larger supply, and the trade has been rather irregular, with a fall in the average price as compared with December of 7*d.* per stone for hindquarters and 2*d.* for fores. There was a rather brisk recovery in the last week on shorter supplies, but the month's averages were: hindquarters, 2*s.* 11*d.* and 2*s.* 7*d.* for first and second quality, and forequarters 2*s.* 5*d.* and 2*s.* 3*d.* The trade for forequarters was steadier than for hinds.

Frozen Beef.—There was absolutely no change in the trade for frozen beef. Hindquarters sold at 2*s.* 4*d.* to 2*s.* 6*d.*, and fores 2*s.* to 2*s.* 1*d.* for New Zealand, Argentine and Australian being a trifle less.

Carcass Mutton—Fresh-Killed.—The supplies of very small Scotch "Hill" carcasses have been very low and not worth quoting, but the trade for 7½ to 8 stone sheep has been fairly good, and prices for that class better than in December. These have averaged 5*s.* 4*d.* and 5*s.* for first and second quality. English realised 5*s.* 1*d.* and 4*s.* 9*d.*, but these are of considerably heavier weight than the Scotch. The season for Dutch has now ended.

Frozen Mutton.—New Zealand mutton has sold at a slightly higher average price than in December. Prices were 3*s.* 4*d.* and 3*s.* 1*d.* per 8 lb. for first and second quality, Argentine making 3*s.* and 2*s.* 10*d.* There has been no Australian mutton in the Central market worth quoting.

Lamb—Fresh-killed.—Very little new season English lamb has yet been offered, but a few Dorset Horn carcasses have fetched 1*s.* per lb.

Frozen Lamb.—Until the last week, when some new season produce made 4*s.* 4*d.* to 4*s.* 8*d.* per stone, New Zealand lamb sold steadily at 3*s.* 11*d.* and 3*s.* 8*d.* for first and second quality. Australian averaged 3*s.* 8*d.* and 3*s.* 7*d.*, and Argentine 3*s.* 6*d.* and 3*s.* 4*d.* per 8 lb.

Veal.—The supply of veal in the London market has been very short except in the second week, and on many days there has been no English that could be classed as first quality. Prices have been high, and the averages were:—British, 6*s.* 2*d.* and 5*s.* 5*d.*, and Dutch, 6*s*. 3*d*. and 5*s*. 5*d*. per 8 lb. A few French calves realised 6*s*. 8*d*. per stone, being of excellent quality.

Pork.—Pork has again met a good demand, while supplies have been by no means excessive. In the London market, small pigs averaged 5*s*. 3*d*., and heavier ones 4*s*. 11*d*. for British, and 4*s*. 11*d*. and 4*s*. 8*d*. for Dutch. Heavy sows have sold well, and have frequently fetched 4*s*. per stone, or 6*d*. per lb.

THE PROVISION TRADE IN JANUARY.

HEDLEY STEVENS.

Bacon.—The month opened with a slow consumptive demand, but prices remained steady. Later prices steadily advanced, and by the end of the month in some districts long sides were selling at from 19*s*. to 21*s*. per cwt. above prices current at the same time last year. Prices now current are as high as those generally experienced in the month of August, when all hog products are in best demand. Naturally these conditions are causing dealers some anxiety, and the trade has been mostly of a hand-to-mouth character. At this time of the year importers of American hog products usually make their contracts for shipments during the summer months, but very little business has been done at the abnormally high prices demanded by the American packers. Trade continues good in the United States, and all hog products in good demand in spite of the high prices current there, and as the Government figures are now available, showing a decrease of about 4½ million live pigs on January 1st in comparison with January 1st, 1912, the American exporters are very "bullish" as to the future. The receipts of pigs at the packing centres have been fairly large, but less than at the same time twelve months back. At Chicago during the month prices have ranged from $7.15 to $7.75, against $5.50 to $6.60 last year, and $7.60 to $8.25 two years back.

English pigs command very high prices, and curers cannot obtain sufficient supplies, but they point out there is a great risk in paying such an exceedingly high price for the raw material in January and February, when the consumption is usually small, and, in addition, the high prices have considerably reduced the consumption, many housekeepers being forced to find a cheaper substitute for the usual breakfast rashers.

Cheese.—There has been another month of slow trading, and considerable anxiety has prevailed as to prices likely to prevail between now and the opening of the new season's make. The stocks in England and Canada are not large for the time of year, but the nervousness shown by buyers is caused by the uncertainty as to the excess quantity of New Zealand makes to reach this country between now and June. It is thought by many well able to judge that the increase from that country this season will be between 7,000 and 8,000 tons, but the cabled shipments up to the end of February do not quite confirm that forecast. At the end of the month prices of imported cheese were 10*s*. to 12*s*. below those current twelve months back, but then prices were abnormal, as a result of the unusually dry weather in most dairying countries in the summer of 1911 and consequent decrease in the quantity manufactured. At present spot prices, importers of both Canadian and New Zealand cheese are losing heavily on their purchases made some months back. Stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 210,000 boxes, against 206,000 boxes at the end of January, 1912, and 266,000 boxes in 1911. Stocks of New Zealands for the same period were 14,000, 10,000, and 14,000 crates respectively.

In the United States of America prices are considerably above an export basis, equal to 84*s.* c.i.f. Liverpool, is being made for extra fine quality.

The stocks of English cheese now on hand are in most districts heavier than usual, but chiefly of the autumn and early winter makes.

Butter.—The month's trading has been of an unsatisfactory nature. Early in the month current figures were from 14*s.* to 18*s.* per cwt. below those in vogue at the same time last year, and by the end of the month prices were further reduced 4*s.* to 6*s.* per cwt., but buyers still lack confidence, and buy only as required for immediate use. With these reductions prices are still high, and except for the very best trade the consumption of butter is below the average, and it is thought by many that the best brands of margarine are being consumed instead. Merchants find it very difficult to dispose of any secondary qualities, irrespective of price.

In Canada and the United States of America prices are considerably above an export basis. In the latter country as high as equal to 150*s.* c.i.f. is being paid for extra fine creameries.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in January, 1913, and December, 1912.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	JANUARY, 1913.		DECEMBER, 1912.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Polled Scots	9 3	8 5	9 3	8 6
Herefords	9 0	8 6	8 11	8 3
Shorthorns	8 11	8 2	8 10	8 1
Devons	8 11	8 1	8 11	8 0
Welsh Runts	9 0	8 3	8 9	8 1
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	9½	8½	9	8
Sheep:—				
Downs	9¾	8¾	9¼	8¼
Longwools	9½	8¼	8½	7¾
Cheviots	10½	9½	9½	8¾
Blackfaced	10¼	9½	9½	8½
Welsh	9¾	9	8½	7½
Cross-breds	9¾	8¾	9¼	8¼
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Bacon Pigs	8 1	7 7	8 1	7 7
Porkers	8 6	7 11	8 7	8 0
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ *s.*	£ *s.*	£ *s.*	£ *s.*
Shorthorns—In Milk ...	24 7	20 13	24 2	20 4
,, —Calvers... ...	23 12	20 9	23 10	19 7
Other Breeds—In Milk ...	20 2	17 12	21 7	17 10
,, —Calvers ...	—	14 5	19 0	14 15
Calves for Rearing	2 9	1 17	2 6	1 16
Store Cattle:—				
Shorthorns—Yearlings ...	10 19	9 9	10 16	9 6
,, —Two-year-olds...	15 4	13 11	15 12	13 10
,, —Three-year-olds	18 7	16 7	19 3	16 13
Herefords—Two-year-olds	16 18	15 0	15 19	14 5
Devons— ,,	15 15	13 17	14 10	12 15
Welsh Runts ,,	—	—	15 12	14 2
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Downs or Longwools ...	46 10	40 8	41 7	35 8
Store Pigs:—				
8 to 10 weeks old	20 8	16 3	19 4	14 10
12 to 16 weeks old	32 0	24 8	30 5	23 4

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in JANUARY, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.		Leeds.		Liverpool.		London.		Manchester.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
BEEF :—											
English	1st	59	0	60	6	55	0	62	0	56	0
	2nd	55	0	58	0	52	0	59	0	53	6
Cow and Bull	1st	53	0	54	6	47	0	46	0	49	6
	2nd	43	6	49	0	41	6	41	6	46	0
Irish : Port killed	1st	54	6	54	6	54	0	58	0	54	0
	2nd	50	6	52	0	50	0	54	6	50	6
Argentine Frozen—											
Hind Quarters	1st	34	0	34	6	34	0	33	6	34	0
Fore ,, ...	1st	30	6	29	6	30	6	29	0	30	6
Argentine Chilled—											
Hind Quarters	1st	42	0	39	0	39	0	41	0	39	0
Fore ,, ...	1st	33	6	31	6	32	0	34	6	32	0
Australian Frozen—											
Hind Quarters	1st	33	6	34	0	31	6	32	6	31	6
Fore ,, ...	1st	29	6	—		28	0	29	0	28	6
VEAL :—											
British	1st	—		78	0	84	6	86	6	81	6
	2nd	72	6	72	6	76	0	76	0	76	0
Foreign	1st	—		—		—		87	6	—	
MUTTON :—											
Scotch	1st	—		—		83	6	74	6	83	6
	2nd	—		—		78	0	70	0	78	6
English	1st	72	0	77	6	77	6	71	0	78	6
	2nd	61	0	74	0	73	6	67	0	74	0
Irish : Port killed	1st	71	0	71	0	77	6	—		77	0
	2nd	60	6	70	0	73	6	—		71	0
Argentine Frozen	1st	41	0	41	6	42	0	42	6	42	0
Australian ,, ...	1st	39	0	39	0	38	0	—		38	0
New Zealand ,, ...	1st	—		—		—		46	6	—	
LAMB :—											
British	1st	—		—		—		112	0	—	
	2nd	—		—		—		—		—	
New Zealand	1st	56	6	—		56	0	57	6	56	6
Australian	1st	53	6	51	6	50	0	52	0	50	6
Argentine	1st	51	6	51	6	50	0	49	6	51	6
PORK :—											
British	1st	72	6	72	6	75	0	73	6	77	0
	2nd	67	6	69	6	69	0	69	0	70	6
Foreign	1st	—		—		—		69	0	—	

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended (*in* 1913).	WHEAT.						BARLEY.						OATS.					
	1911.		1912.		1913.		1911.		1912.		1913.		1911.		1912.		1913.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 4 ...	30	5	33	2	30	5	23	11	33	3	28	6	17	0	20	7	19	10
,, 11 ...	30	8	33	1	30	3	23	10	33	0	28	4	17	2	20	8	19	2
,, 18 ...	30	11	33	4	30	5	24	4	33	3	28	6	17	4	20	11	19	4
,, 25 ...	30	11	33	7	30	11	24	5	33	1	28	10	17	3	21	1	19	4
Feb. 1 ...	30	9	33	8	31	1	24	5	32	10	28	11	17	5	21	3	20	2
,, 8 ...	30	5	34	0	31	0	24	6	33	2	28	10	17	5	21	4	20	1
,, 15 ...	30	3	34	4			24	7	32	10			17	6	21	7		
,, 22 ...	30	2	34	6			24	9	32	8			17	7	21	9		
Mar. 1 ...	30	0	34	1			25	0	32	0			17	5	21	6		
,, 8 ...	30	1	34	1			25	0	31	7			17	5	21	8		
,, 15 ...	30	1	34	0			24	11	31	2			17	6	21	8		
,, 22 ...	30	2	34	1			25	0	31	10			17	5	21	9		
,, 29 ...	30	3	34	4			24	11	30	3			17	5	21	8		
Apl. 5 ...	30	4	34	10			24	7	30	9			17	7	21	11		
,, 12 ...	30	3	35	4			25	2	30	2			18	3	22	1		
,, 19 ...	30	4	36	7			25	5	29	11			17	10	22	4		
,, 26 ...	30	11	37	10			25	5	30	4			18	3	22	9		
May 3 ...	31	4	38	1			25	7	30	2			18	6	23	1		
,, 10 ...	31	8	37	11			25	1	31	1			19	0	23	7		
,, 17 ...	32	6	37	8			25	4	31	2			19	2	23	7		
,, 24 ...	32	8	37	2			25	0	31	1			19	5	23	7		
,, 31 ...	32	5	36	10			24	10	30	0			19	5	23	9		
June 7 ...	32	4	36	11			25	7	29	11			19	7	24	0		
,, 14 ...	32	3	37	0			23	11	30	8			19	8	23	10		
,, 21 ...	31	11	37	5			23	9	30	8			19	10	24	0		
,, 28 ...	31	10	37	10			24	5	30	2			19	9	23	11		
July 5 ...	32	1	38	2			25	10	31	7			19	9	23	11		
,, 12 ...	32	3	38	3			25	10	30	2			19	11	24	1		
,, 19 ...	32	5	38	10			24	3	30	9			19	5	24	8		
,, 26 ...	32	5	38	9			23	8	30	9			19	7	23	4		
Aug. 2 ...	32	0	38	4			24	4	28	6			18	2	22	2		
,, 9 ...	31	6	39	2			26	9	30	7			18	0	22	4		
,, 16 ...	31	6	38	2			27	8	28	3			17	10	21	8		
,, 23 ...	31	8	35	6			28	10	28	1			18	0	20	10		
,, 30 ...	31	7	34	10			28	4	28	6			18	3	20	8		
Sept. 6 ...	31	10	35	1			28	4	29	9			18	1	21	8		
,, 13 ...	32	0	33	5			29	0	29	0			18	5	20	5		
,, 20 ...	32	4	32	7			29	11	29	6			18	9	19	10		
,, 27 ...	32	6	31	7			30	5	29	9			19	1	19	5		
Oct. 4 ...	32	7	31	8			30	9	29	7			19	5	19	8		
,, 11 ...	32	9	31	10			31	0	30	4			19	10	19	5		
,, 18 ...	32	9	32	2			31	5	30	11			19	11	19	9		
,, 25 ...	33	1	33	1			31	7	31	6			20	6	19	10		
Nov. 1 ...	33	4	33	4			31	10	31	10			20	8	20	1		
,, 8 ...	33	4	33	1			32	7	31	11			20	11	19	11		
,, 15 ...	33	1	32	10			32	10	31	2			21	0	19	9		
,, 22 ...	33	0	32	1			33	5	30	11			20	10	19	11		
29 ...	32	10	31	9			33	10	30	8			20	11	19	8		
Dec. 6 ...	32	9	31	0			34	0	29	11			20	9	19	6		
,, 13 ...	32	11	30	8			33	5	29	2			20	9	19	3		
,, 20 ...	32	9	30	7			33	5	28	11			20	8	19	1		
,, 27 ...	33	0	29	10			33	4	28	6			20	7	19	2		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1912.	1913.	1912.	1913.	1912.	1913.
		s. d.	*s. d.*	*s. d.*	*s. d*	*s. d.*	*s. d.*
France:	January	44 4	47 2	28 8	30 4	22 9	24 0
Paris:	January	46 11	48 9	28 8	31 3	23 5	23 11
		1911.	1912.	1911.	1912.	1911.	1912.
Belgium:	November	33 10	35 1	27 11	31 2	22 9	24 3
	December	34 1	36 7	28 11	30 6	23 4	25 4
Germany:	November	42 9	42 3	35 1	32 7	25 0	24 0
	December	43 2	40 1	35 9	30 8	25 3	22 8
Berlin:	November	43 7	44 1	—	—	25 2	25 5
	December	43 9	44 0	—	—	25 10	24 1
Breslau:	November	39 9	39 11	32 6* 27 7†	32 4* 28 5†	23 6	23 8
	December	39 11	38 3	32 10* 27 7†	30 6* 27 6†	24 1	21 11

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of January, 1912 and 1913.

—	WHEAT.		BARLEY.		OATS.	
	1912.	1913.	1912.	1913.	1912.	1913.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London	34 6	32 2	32 3	25 8	22 11	21 7
Norwich	32 11	31 6	33 1	26 5	21 2	19 10
Peterborough	32 9	27 11	30 4	26 0	21 2	17 2
Lincoln	33 4	28 10	32 11	29 7	21 3	20 0
Doncaster	33 0	28 6	32 6	26 11	20 7	18 11
Salisbury	32 10	31 2	33 4	30 6	20 4	19 5

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in January, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	16 0	15 0	—	—	17 0	15 6
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery ...	114 0	110 6	—	—	116 0	114 0
,, Factory	105 0	93 0	104 6	94 6	108 0	104 0
Danish	—	—	128 6	125 6	129 0	126 6
French	—	—	—	—	129 0	123 0
Russian	111 0	106 0	109 0	106 0	112 0	109 6
Australian	116 6	114 0	114 6	112 0	113 6	111 6
New Zealand ...	120 6	117 6	119 0	116 6	118 0	116 0
Argentine	116 6	114 6	115 0	112 0	111 6	109 6
CHEESE :—						
British—						
Cheddar	76 6	72 0	74 6	72 0	76 0	72 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	77 0	72 0	81 6	77 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	65 0	61 0	64 6	61 6	64 0	63 0
BACON :—						
Irish	75 0	71 6	75 6	72 0	77 0	74 6
Canadian	70 6	67 6	69 6	67 0	70 6	68 6
HAMS :—						
Cumberland	—	—	—	—	110 0	104 0
Irish	—	—	—	—	106 6	102 6
American (long cut) ...	69 6	67 0	68 6	66 0	68 6	65 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	15 2	12 8	—	—	13 11	12 11
Irish	13 4	13 1	13 2	12 2	12 6	11 6
Danish	—	—	13 6	12 9	12 9	11 3
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.
Edward VII. ...	100 0	85 0	80 0	78 6	102 6	92 6
Langworthy	105 0	95 0	96 6	90 0	117 6	107 6
Up-to-Date	91 6	82 6	78 6	75 0	97 0	88 0
HAY :—						
Clover	105 0	90 0	117 6	95 0	130 0	103 0
Meadow	100 0	80 0	—	—	119 0	97 0

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	JANUARY.	
	1913.	1912.
Anthrax :—		
Outbreaks	50	92
Animals attacked	61	102
Foot-and-Mouth Disease :—		
Outbreaks	—	—
Animals attacked	—	—
Glanders (including Farcy) :—		
Outbreaks	13	12
Animals attacked	61	31
Parasitic Mange :—		
Outbreaks	340	648
Animals attacked	824	1,791
Sheep-Scab :—		
Outbreaks	45	63
Swine-Fever :—		
Outbreaks	146	229
Swine Slaughtered as diseased or exposed to infection ...	1,981	2,540

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	JANUARY.	
	1913.	1912.
Anthrax :—		
Outbreaks	—	1
Animals attacked	—	1
Foot-and-Mouth Disease :—		
Outbreaks	—	—
Animals attacked	—	—
Glanders (including Farcy) :—		
Outbreaks	—	—
Animals attacked	—	—
Parasitic Mange :—		
Outbreaks	37	8
Sheep-Scab :—		
Outbreaks	77	86
Swine-Fever :—		
Outbreaks	24	11
Swine Slaughtered as diseased or exposed to infection ...	99	146

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

Partial Sterilisation of Soil: Lecture delivered by Dr. Russell (Rothamsted Experiment Station), on 20th November, at Annual Conference of the National Chrysanthemum Society. (Gard. Chron., Vol. LII. (3rd Ser.), No. 1,353, 30th November, 1912.) [63.115.]

Soils from the East Africa Protectorate. (Bul. Imperial Inst., Vol. X., No. 3, October, 1912.) [63.111.]

The Conditions of Russian Agriculture, *J. Vargas Eyre.* (Sci. Prog., No. 26, October, 1912.) [63(47).]

Field Crops—

Anbauversuche mit einjährigem Raigras, *Dr. Ahr.* (Prak. Bl. Pflanzenbau- u. -schutz, Oktober, 1912.) [63.33(*d*).]

Horticulture—

The Flowers of Apples as an aid in identifying Varieties, *E. A. Bunyard.* [63.41(*a*).] The Pollination and Setting of Fruit Blossoms and their Insect Visitors, *C. H. Hooper.* [63.41(04).] (Jour. Roy. Hort. Soc., Vol. XXXVIII., Pt. 2, November, 1912.)

Horticultural Research. I., The Planting of Trees. *Spencer Pickering.* (Sci. Prog., No. 26, October, 1912.) [63.42.]

Plant Diseases—

"White-heads" or "Take-all" of Wheat and Oats (*Ophiobolus graminis,* Sacc.), *G. Massee.* (Bul. Misc. Inform., Kew, No. 10, 1912.) [63.24.]

Ergebnisse und Probleme auf dem Gebiete der Nonnenforschung in Österreich, *W. Sedlaczek.* (Centbl. Gesam. Forstw., Dezember, 1912.) [63.27.]

Beiträge zur Biologie der Getreide-Fusarien, *E. Schaffnit.* (Jahresber. Angew. Bot., 1911.) [63.24–31.]

Untersuchungen über die Biologie der Nonne, *M. Wolff.* (Jahresber. Angew. Bot., 1911.) [63.27.]

Vergleichende Versuche über die Wirkung verschiedener Mittel und Methoden zur Bekämpfung der Feldmausplage, *Korff.* (Prakt. Bl. Pflanzenbau- u. -schutz, Dezember, 1912.) [63.269.]

Live Stock—

Studien über das Brachyceros-Rind des östlichen Mitteleuropa, im besonderen an einem primitiven Landschlage des Wolhynischen Polessje, *Dr. S. Lipinski.* (Mitt. landw. Inst., Leipzig, Elftes Heft, 1912.) [59.9; 63.62.]

Über die Zusammensetzung und den Wert von Weizenausputz, sogen Kriblon, als Futtermittel, *Dr. M. Kling.* (Landw. Vers. Stat., Bd. LXXVIII., Heft III. u. IV., 1912.) [63.604(*a*).]

Inheritance of Coat-colour in Rabbits, *R. C. Punnett.* (Jour. Genetics, Vol. 2, No. 3, November, 1912.) [575.1.]

Dairying—

Cheesemaking. Notes on Cheddar, Stilton and Wensleydale, *J. C. Newsham.* (Dairying and Dairy-Farming, published by Dairy Students' Union.) [63.736.]

Forestry—

The raising and management of thorn hedges, *W. Hall.* [63.499.] On the relation of light-intensity to advance growth in oak and beech forests, *G. P. Gordon.* [63.491.] (Trans. Roy. Scot. Arbor. Soc., Vol. XXVI., Pt. II., July, 1912.)

Economics—

Financial Return from different branches of farming. (Trans. Surv. Inst., Vol. XLV., Pt. 1, November, 1912.) [338.1.]

ADDITIONS TO THE LIBRARY.

Dairying and Food, General—

North Dakota Agricultural Experiment Station.—Bull. 91:—Dairy Herd Records: (*a*) Studies in Cost of Production; (*b*) Individual Types; (*c*) Individual Feed Requirements. (127–168 pp.) Fargo, N.D., 1911. [63.711.]

North Carolina Agricultural Experiment Station.—Bull. 220:—Care and management of the dairy herd. (74–84 pp.) Raleigh, 1911. [63.711.]

South-Eastern Agricultural College, Wye.—Winter feeding of dairy cows. (31 pp.) [1912.] [63.711.]

Wisconsin Agricultural Experiment Station.—Circ. of Information 37:—The feed unit system for determining the economy of production by dairy cows. (15 pp.) 1912. [63.711.]

U.S. Department of Agriculture, Bureau of Animal Industry.—Bull. 148:—The manufacture of butter for storage. (27 pp.) [63.72.] Bull. 150:—The Bacteriology of Cheddar Cheese. (52 pp. + 1 plate.) [576.8; 63.736.] Bull. 154:—Methods of classifying the lactic-acid bacteria. (30 pp.) [576.8.] Washington, 1912.

Rose, Laura.—Farm Dairying. (303 pp.) London: T. Werner Laurie, 1912. 6*s.* net. [63.70(02).] [The author is Lecturer in Dairying at the Ontario Agricultural College, Guelph, Canada.]

Veterinary Science—

U.S. Department of Agriculture, Bureau of Animal Industry.—Bull. 153:—The action of anthelmintics on parasites located on the outside of the alimentary canal. (23 pp.) [59.169.] Bull. 158:—The Roundworms of Domestic Swine, with special reference to two species parasitic in the stomach. (47 pp. + 1 plate.) 1912. [619.4; 59.169.] Circ. 207:—Directions for Constructing Vats and Dipping Cattle to Destroy Ticks. (20 pp.) 1912. [59.169(*b*).] Washington.

North Dakota Agricultural Experiment Station.—Bull. 94:—Swamp Fever in Horses. (255–353 pp. + iii. plates + diagrams.) Fargo, N.D., 1911. [619.1.]

Lander, G. D.—Veterinary Toxicology. (312 pp.) London: Baillière, Tindall & Cox, 1912. 7*s.* 6*d.* net. [63.259(02); 619(02).]

Birds, Poultry, and Bees—

Cornell Agricultural Experiment Station.—Bull. 318:—Constitutional Vigour in Poultry. (569–616 pp.) [63.651.] Circ. 14:—Working Plans of Cornell Poultry Houses. (24 pp.) [63.6:69.] Ithaca, N.Y., 1912.

U.S. Dept. of Agriculture, Bureau of Animal Industry.—Circ. 206:—Hints to Poultry Raisers. (5 pp.) Washington, 1912. [63.651.]

Canada, Dept. of Agriculture, Branch of Live Stock Commissioner.—Bull. 16:—The Care of Market Eggs. (24 pp.) Ottawa, 1912. [63.74.]

Rhode Island Agricultural Experiment Station.—Bull. 146:—A Biological Study of Eleven Pathogenic Organisms from Cholera-like Diseases in Poultry. (41–102 pp.) 1911. [619.5(*a*).] Bull. 150:—Studies on Fowl Cholera. II.—The Rôle of an Homologous Culture of Slight Virulence in the Production of Active Immunity in Rabbits. (80–161 pp.) [619.5(*a*).] Kingston, R.I., 1912.

*Lewer, S. H.**—Wright's Book of Poultry; revised and edited in accordance with the latest Poultry Club standards. (627 pp.) London: Cassell & Co., 1912. 21*s.* net. [63.65(02).]

Mansfield, G. M.—Poultry on Small Areas of Ground; or, the Philo System adapted to the British Isles. (27 pp.) London: R. T. Lang, Ltd., 1911. 1*s.* net. [63.651.]

Purdue Agricultural Experiment Station.—Circ. 37:—Housing Farm Poultry. (16 pp.) Lafayette, Indiana, 1912. [63.6:69.]

Kansas Agricultural Experiment Station.—Circ. 27:—Capons for Kansas. (14 pp.) Manhattan [1912]. [63.651.]

*Ziegler, Dr. H. E. (edit.).**—Zoologisches Wörterbuch: Erklärung der zoologischen Fachausdrücke. Dritte (Schluss-) Lieferung. (481–737 pp.) Jena: Gustav Fischer, 1912. [59(02).]

Ireland, Department of Agriculture and Technical Instruction.—Instruction in Bee-keeping for the use of Irish Bee-keepers. [New edition.] (88 pp. + plates.) London: Wyman & Sons, 1912. 9*d.* [63.81(02).]

U.S. Department of Agriculture, Bureau of Chemistry.—Circ. 104:—A study of the enzymes of the egg of the common fowl. (8 pp.) Washington, 1912. [63.74.]

Davenport, C. B.—Inheritance in Poultry. (136 pp. + 17 plates.) [Carnegie Institution of Washington Publication, No. 52.] Washington, 1906. $1.00. [575.1; 63.65(02).]

U.S. Department of Agriculture, Bureau of Entomology.—Bull. 98:—Historical Notes on the Causes of Bee Diseases. (96 pp.) Washington, 1912. [63.81.09.]

U.S. Department of Agriculture.—Farmers' Bulletin 506:—Food of some Well-known Birds of Forest, Farm, and Garden. (35 pp.) Washington, 1912. [59.162.]

Forestry—

Elwes, H. J., and *Henry, A.**—The Trees of Great Britain and Ireland. Vol. VI. (1335–1651 pp. and plates.) Edinburgh: Privately Printed. [63.49: 58; 63.49(42).]

Vermont Forest Service.—Publication No. 7:—Instructions to Forest Fire Wardens and Woodland Owners regarding Forest Fires. (19 pp.) 1911. [63.49–2.]

U.S. Department of Agriculture, Forest Service.—The National Forest Manual: Instructions to Forest Officers Relating to Forest Plans, Forest Extension, Forest Investigations, Libraries, Co-operation and Dendrology. (45 pp.) 1911. [63.49(73).] Bull. 117:—Forest Fires: their causes, extent and effects, with a summary of recorded destruction and loss. (39 pp.) 1912. [63.49–2.] Washington.

Bersch, Josef.—Die Verwertung des Holzes auf chemischen Wege [Dritte Auflage]. (331 pp.) Wien und Leipzig: A. Hartleben, 1912. 4.50 marks. [668.7.]

Engineering—

North Dakota Agricultural Experiment Station.—Bull. 97:—Barn Plans. (59 pp.) [69.] Bull. 99:—The Adjustment and Repair of Self-Binders. (28 pp.) [63.17.] Fargo, N.D., 1912.

*Departmental Committee on Duration of Buildings for Small Holdings.**—Report. [Cd. 6536.] (21 pp.) London: Wyman & Sons, 1912. 2½*d.* [69; 333.38(42).]

Bruël, R.—Billige Ladebygninger. (32 pp.) Kobenhavn, 1912. [69.]

Churton, A.—The Housing and Town-planning Act, 1909, as it affects Rural Districts. [Our Land Reprints.—IV.] (12 pp.) London: P. S. King & Son. 2*d.* [333.32.]

Broounoff, P.—Les Cultures Agricoles et le Temps. Notice relative à l'adaptation des Agriculteurs aux Conditions climatériques. (44 pp.) St. Petersburg, 1912. [551.5.]

Broounoff, P.—Quelques Considerations sur l'Organisation du Service Météorologique dans les Buts de l'Agriculture. (12 pp.) St. Petersburg, 1912. [551.5.]

Broounoff, P.—Quelques données sur le Bureau Météorologique du Comité Scientifique du Ministère de l'Agriculture [Russia]. (7 pp.) [551.5.]

Wisconsin Agricultural Experiment Station.—Circ. of Information 34:—Sewage disposal for rural homes. (15 pp.) Madison, Wis., 1912. [628.2.]

Rural Housing Association.—Cottages for Rural Labourers. [Our Land Reprints.—V.] (24 pp.) Westminster: P. S. King & Son, n.d. 4*d.* net. [69.]

U.S. Department of Agriculture.—Farmers' Bull. 505:—Benefits of Improved Roads. (20 pp.) Washington, 1912. [625.7.]

Economics—

Pratt, Edwin A.—Agricultural Organisation: Its Rise, Principles and Practice abroad and at home. (x. + 259 pp.) London: P. S. King & Son, 1912. 3*s.* 6*d.* net. [334(02).]

Bulstrode, W.—Co-operative Farming. (23 pp.) London: P. S. King & Son, 1908. 3*d.* net. [334(04).]

Russell, The Hon. Rollo.—The Distribution of Land. (46 pp.) London: P. S. King & Son, 1907. 3*d.* net. [333.]

Fox, A. Wilson.—The Rating of Land Values: Notes upon the Proposals to levy Rates in respect of Site Values. [2nd edition.] (153 pp.) London: P. S. King & Son, 1908. 3*s.* 6*d.* net. [336.22.]

Orr, J.—Taxation of Land Values as it affects Landowners and Others. (116 pp.) London: P. S. King & Son, 1912. 1*s.* net. [336.22.]

Methorst, H. W.—Texte des Voeux émis par l'Institut International de Statistique dans les treize premières Sessions. (116 pp.) [Supplément au tome xix. du Bulletin de l'Institut International de Statistique.] [311.]

Secrétariat suisse des Paysans.—Publication No. 44:—Enquête sur l'état de l'Association dans l'Agriculture Suisse au 1er Janvier, 1910. (138 pp.) Berne, 1912. [334(494).]

Davenport, F. G.—The Economic Development of a Norfolk Manor, 1086–1565. (105 + cii. pp.) Cambridge: University Press, 1906. 10*s.* net. [333.5.]

Goddard, A.—Report of Departmental Committee on Sales of Estates. [Journal of the Farmers' Club, April and June, 1912.] (41–62 pp. and 85–102 pp.) London: Wyman & Sons. 6*d.* each. [333.5; 347(*a*).]

Hart-Synnot, R.—The Development Fund and its distribution. [Journal of the Farmers' Club, November, 1912.] (103–126 pp.) London: Wyman & Sons. 6*d.* [338.98.]

U.S. Department of Agriculture, Bureau of Plant Industry.—Bull. 259:—What is Farm Management? (84 pp.) Washington, 1912. [35(73); 338.1.] [Includes a description of the work of the Office of Farm Management of the U.S. Department of Agriculture.]

U.S. Department of Agriculture, Bureau of Statistics.—Bull. 94:—Supply of Farm Labor. (81 pp.) [331.] Bull. 99:—Wages of Farm Labor. (72 pp.) [331.] Washington, 1912.

Tawney, R. H.—The Agrarian Problem in the Sixteenth Century. (464 pp. + vi. maps.) London: Longmans, Green & Co., 1912. 9*s.* net [333.5; 63(09).]

*Wohlin, N.**—Den Svenska Jordstyckningspolitiken i de 18:de och. 19:de Arhundradena. (852 pp.) Stockholm, 1912. [63(485); 333.5.]

*Board of Trade, Labour Department.**—Report on Profit Sharing and Labour Co-Partnership in the United Kingdom. [Cd. 6496.] (160 pp.) London: Wyman & Sons, 1912. 8½*d.* [331.]

*Census of Production.**—Final Report on the First Census of Production of the United Kingdom (1907) with Tables. [Cd. 6320.] (938 pp.) London: Wyman & Son, 1912. 7*s.* 6*d.* [31(42).]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P. 10—9. 6,000. 2/13. R. C. & S., Ltd.

THE JOURNAL
OF THE
BOARD OF AGRICULTURE

Vol. XIX. No. 12.

MARCH, 1913.

CULTIVATION OF TOBACCO FOR THE PREPARATION OF FRUIT AND HOP WASHES.

THE high value of nicotine, the characteristic alkaloid of tobacco, as an insecticide and acaricide, has long been recognised, and there can be no doubt that if it were obtainable at a sufficiently low price it would be used to an enormous extent as a constituent of washes for fruit and hops and of sheep dips. It poisons insects and related forms that have soft delicate bodies. Pure nicotine is a colourless, volatile liquid; it becomes brown on exposure to the air. One advantage of a pure nicotine solution is that it does not stain the material sprayed. At present, commercial nicotine costs about 15*s*. per lb., which makes its use impracticable in ordinary cases. This commercial nicotine is practically pure, and is prepared from inferior and refuse tobacco. The high price is due partly to the limited supply but also largely to the cost of preparation and purification, and the fact that the manufacture is hampered by the strict regulations necessary to ensure that none of the tobacco intended for nicotine production, on which no duty is paid, is used for smoking purposes is doubtless also a contributing factor. It does not seem probable that the price of the manufactured product will decrease, but there is good reason to believe that fruit and hop growers could, by growing suitable varieties of tobacco in such a way as to encourage nicotine production, and by avoiding altogether the elaborate and expensive system of manufacture, produce their own insecticidal nicotine washes at a cost low enough to enable them to compete with the cheaper but less effective and less desirable washes in common use.

By section 4 of the Finance Act, 1912, the Commissioners of Customs and Excise may authorise duly licensed persons to grow tobacco without payment of duty, for the sole purpose of obtaining extract to be used for purely agricultural or horticultural purposes.*

It should, however, clearly be understood that the growth of tobacco is, at present, and will be, in the future, illegal except with a licence from the Commissioners of Customs and Excise, and subject to the observance of such conditions as they may impose.†

The Board think it may be useful to publish some general information for the guidance of any growers who may contemplate the growth of tobacco with a view to the preparation of fruit or hop washes for their own gardens or orchards.

It is not intended in this article to deal with the cultivation of tobacco for smoking purposes. The cultivation for nicotine production must be regarded as quite distinct from the growth of the crop for smoking; the varieties, soil, manuring, and treatment suitable in the one case are not at all desirable in the other. It is found that the highest percentage of nicotine and the greatest weight of tobacco per acre are obtained from rank, coarse-growing varieties, treated in such a way as to encourage their tendency to strength of growth as much as possible. In a high quality smoking tobacco, good flavour, aroma, coolness, and smoothness of smoke, along with good burning powers, are essential, and these characters cannot be obtained in the coarse, rank growth desired for nicotine production. Another point of difference which must be mentioned is that in ordinary tobacco cultivation heavy expense has to be incurred in curing, grading, and packing the tobacco. As explained later, a fruit or hop grower would only have to dry his tobacco, and this can be done very simply and cheaply.

---

* The full text of the Clause is as follows:—The Commissioners of Customs and Excise may authorise responsible persons duly licensed to grow tobacco within the United Kingdom, to grow tobacco for the sole purpose of obtaining an extract therefrom to be used, without payment of duty, in the manufacture of insecticides or sheepwash or for other purely agricultural or horticultural purposes. The authority shall be granted subject to such security and the observance of such regulations and conditions as the Commissioners may prescribe, and, if any person so authorised acts in contravention of or fails to comply with any of those regulations or conditions, the article in respect of which the offence is committed shall be forfeited, and the person committing the offence shall be liable in respect of each offence to an Excise penalty of fifty pounds.

† The Regulations which have been made by the Commissioners of Customs and Excise under Section 4 of the Finance Act will be found on p. 1040.

At present practically no tobacco is grown in any part of the world merely for nicotine production, and suggestions as to cultivation for this purpose must be made with the reservation that they are merely intended as a rough outline of the methods likely to be found most satisfactory. As experience is gained, modifications will doubtless suggest themselves, both as to increasing the yield of nicotine per acre and to lessening the cost of production.

The recommendations made are largely based on the results obtained in experiments conducted by the South-Eastern Agricultural College in Kent during the seasons 1910 and 1911, and reported on by Mr. G. H. Garrad and Mr. D. R. Edwardes-Ker.

Types of Tobacco.—Tobacco is an annual plant belonging to the genus *Nicotiana* of the natural order *Solanaceae* (the order to which the potato and tomato belong), and there are two species in common cultivation, namely, *N. Tabacum* and *N. rustica*; the varieties of tobacco usually grown for smoking purposes belong to the former species, while *N. rustica* produces a rank, low-quality tobacco, though its proportion of nicotine is high. The latter species has the further advantage of being quick-growing and comparatively early in maturing, and it seems to be almost certain that some variety of *N. rustica* will prove most suitable for nicotine production in our climate.

The percentage of nicotine in a crop depends to a great extent upon conditions of environment, *e.g.*, climate, soil, manuring, and system of cultivation; but under the same conditions, different varieties contain widely different proportions, and the tendency to produce a high or low percentage of nicotine is inherited. Up to the present, tobacco growers have been inclined to select for low nicotine content, and there is no reason to doubt that by aiming at the opposite character, new varieties, which would contain more nicotine than any available at present, could be raised.

Climatic and Soil Conditions suitable for the [illegible] For the production of a high quality smoking tobacco it is generally agreed that a warm, dry climate is essential, and a considerable amount of sun and heat in the later stages of growth undoubtedly favours also the production of nicotine; but the climate of many parts of England and Wales is quite suitable for the growth of low quality tobacco. The crop is fairly hardy, but seedlings must not be planted out in the field until the fear of frost is past. As to soil, the content of nicotine seems as a rule to be highest on comparatively heavy soils, and it would be desirable to select a strong loam containing a good deal of organic matter. The richer the soil, the higher will be not only the weight of crop per acre, but the percentage of nicotine in the crop, and in Kent an old hop garden, recently grubbed, has proved to be eminently suitable. Recently ploughed grass land, though it may be rich and of the right texture, is not so good, as it is liable to be infested with wireworms, leather jackets, &c., which do a good deal of damage. Slugs, too, are very destructive to young tobacco plants.

Quite as important as the nature of the soil is the question of shelter; a tobacco crop may be practically destroyed in a few hours by exposure to a gale, and it is essential that a well-sheltered position should be selected. If a small area, naturally protected by orchards, plantations, buildings, &c., is not available, protection must be provided. For this purpose screens of hop lewing may be erected, or strips of tall strong plants, such as Jerusalem artichokes, Kentucky hemp, or even autumn-sown beans, might be tried. If desired, tobacco can be grown for several years on the same piece of ground, provided that it is suitably manured every year, though it is inadvisable to continue this practice too long.

Cultivation and Manuring.—The crop occupies a field for only a short time, and in that period has to make a very large growth; deep and thorough cultivation and a fine condition of soil are therefore essential if success is to be attained, and if the soil is not already rich, liberal manuring is necessary. Probably the best system is to give a good dressing of farmyard manure, and to supplement it with suitable artificials. Following a grain crop on a somewhat heavy soil in not very high condition, the following might be tried:—20 tons per acre of farmyard manure ploughed under in autumn or winter; 3 cwt. of superphosphate, and 1 cwt. of sulphate of potash per acre harrowed in before the seedlings are transplanted; 2 cwt. of nitrate of soda per acre given in two or three top-dressings, beginning as soon as the plants have become well established. For smoking tobaccos, manures containing chlorine are regarded as undesirable, as they are said to affect the burning qualities of the tobacco, and also to check the growth, so that sulphate of potash is preferable to kainit or muriate of potash.

Seed-bed and Sowing.—In this country it is necessary to raise the seedlings in a warm frame, and the time of sowing should be adjusted so as to have the plants ready for setting out as soon as there is no fear of frost. In Kent, about the middle of March seemed a suitable time for sowing, the transplanting taking place about the end of May. The tobacco seed is extremely small, and it is necessary to take special precautions to ensure even distribution. The aim should be to give each seedling about one square inch, and with average germination, one ounce of seed of *N. rustica* is sufficient for about 100 square yards of seed-bed, that is, about ¼ oz. for frames of nine sashes each 6 ft. by 4 ft. The latter quantity might be expected to provide quite enough plants for an acre. Perhaps the best method of sowing is to mix the seed with some white meal or ashes and to scatter the mixture as evenly as possible over the beds; the white material shows up against the dark soil, and uniformity of distribution can thus be secured. As the seed is so small, its reserve of food is soon exhausted, and it is important that the bed should be in an exceptionally fine condition in order to give the tiny seedlings a chance. American and South African experts recommend that the top inch or two of the soil should be sterilised by heating or steaming so as to kill the seeds of weeds and to lessen the risk of disease and insect attack. After sowing the seed, the surface should be slightly pressed with a flat board, and a little fine sand may then be sifted over the beds to cover the seed and prevent the caking of the surface. Finally, a watering from a very fine nozzle should be given. The seedlings are ready for transplanting when they are f ee to four inches high, and have from six to eig . If too thick in the beds, thinning must be carried out, and the usual precautions with regard to ventilation, watering, and hardening off should be taken. What is desired is a stout, sturdy plant with good root development.

Transplanting.—The ground to be occupied with the crop should be manured as suggested above, and worked into a condition as fine as possible by the time the seedlings are ready for transplanting. It should then be marked out by a plough, turnip drill or some similar means, and if it is desired to have horse cultivation in two directions the marking also should be carried out in two directions, so as to divide the ground into squares, a plant being placed at each corner. The distance between the plants undoubtedly has a great effect on the weight of crop and the percentage of nicotine; probably it will be found necessary to vary the distance a little according to the variety grown and to the conditions of soil, but 25 in. each way is suggested as being probably a good average distance.

Transplanting is done in the usual way, using a dibble, but special care should be exercised to avoid damage to the roots. In most tobacco-growing countries it is the general practice to water immediately after transplanting, but in our cooler and moister climate this would not always be necessary. A few seedlings should be reserved to fill up gaps caused by failures.

After Cultivation.—As soon as the plants are well established, both horse and hand hoeing should be commenced and continued as long as possible. Hoeing must, however, cease as soon as the leaves spread in the rows so much that damage is caused by moving among the crops, so that it is particularly important that weeds should be thoroughly dealt with early in the season.

"*Topping*" *and* "*Suckering.*"—If allowed to do so, the plant will send up flowering heads and produce seed. The seed so formed is produced at the expense of the leaves and stems, which would thus become almost worthless. In order to avoid this, the flower stalk must be removed before the seed is formed, and it is desirable to remove at the same time any leaves which are considered to be in excess of the number which the plant can properly ripen. In Kent it appeared to be desirable to allow not more than twelve leaves to each plant. Irish experiments have suggested that "topping" should not be done until the first flower has opened. As soon as the plants have been "topped," and possibly before, small shoots, usually referred to by growers as "suckers," start out from the axils of the leaves on the main stem; these, if allowed to grow, would weaken the plant, and must therefore be broken off. Fresh shoots will soon appear, and the process must be repeated at intervals of about ten days.

Harvesting.—Ripening is indicated by the leaves changing to a lighter shade of green, curling over at the edges, and becoming rather brittle. The leaves on any one plant do not all ripen at once, and in many cases the crop is picked over several times, at each time only the ripe leaves being selected. For nicotine production, however, the increased return would not justify the greater expense of this method, and a cheaper system in which the whole plant is removed will probably prove more satisfactory. The plant should be cut when the middle leaves are ripe, which in America is usually about thirty days after "topping," though in a moist climate ripening may be considerably slower. In Kent about the beginning of September seemed the most suitable time in the hot season of 1911. When the whole plant is to be cut and stored it is necessary to go carefully over the crop to remove "suckers" just before cutting, as otherwise the young shoots will continue to grow for some weeks after the crop has been harvested. The stems are very hard and woody, and a strong hedging slasher or similar tool is necessary.

The plants should not be cut when wet with dew, and after they have been cut they should be left on the ground for an hour or two to wilt a little. The leaves rapidly become limp, and in that state are much less easily knocked off. A convenient plan of dealing with the plants is to collect and tie them separately on to sticks. A stick 5 ft. long will accommodate about eight plants, and may be supported at the ends by laying across two poles, the plants being allowed to hang head downwards. If desired they could be at once hung up in sheds, but in order to reduce the weight to be dealt with, it is better, if the weather is favourable, to leave them suspended on a scaffolding under the shelter of a big hedge or plantation for a week or so to allow of a preliminary drying. After this they may be taken to the homestead and hung up in any convenient building to dry. The only essentials are a watertight roof and fairly good circulation of air. The sticks may be placed about 4 in. apart.

If a hop oast or other suitable means of artificially drying the leaves is available, the plants after drying naturally for say eight or ten weeks, should be taken down, and the leaves stripped from the stalks. The latter contain too little nicotine to pay for extraction, and may be discarded. The leaves, after being dried by artificial means, should be stored in heaps in a dry building until required for making extract.

If no suitable means of finishing off the drying process is available, the best plan would probably be to leave the plants hung up all the winter, and to take off the leaves as they are required in the following summer.

Extraction of Nicotine and Preparation of Washes.—The preparation of washes from the dried tobacco leaves is a very simple matter, as nicotine readily dissolves in cold water. The leaves should be broken up as finely as possible, and then treated with three successive quantities of water in the proportion of one gallon of water to 1 lb. of leaves each time. It is best to allow one day for each extraction, but the length of time can be considerably reduced without greatly diminishing the quantity of nicotine extracted. The water may be quite cold, but a slightly better extraction results if it is warm; in any case the temperature should not be above 140° F., or nicotine will be lost by volatilisation.

The strength of the extract thus obtained will naturally depend on the percentage of nicotine in the leaves. This in turn depends on the dryness of leaves, the nature of season, variety of tobacco, the system of cultivation, &c. Until further trials have been made, it is impossible to say what percentage may be expected under any particular conditions. Probably under good conditions about 4 per cent. of nicotine in the leaves is not too high an estimate. Assuming this, the three gallons of extract, if made up to five gallons with water, give a solution containing rather over ·075 per cent. of nicotine. This at Wye was found to be effective against aphis on hops. Before preparing sprays, it would, however, be necessary to have the percentage of nicotine in the leaves ascertained by an analyst, so that the requisite strength of wash might be accurately obtained.

Cost of Growing and Returns per Acre.—The crop, as will be seen from the foregoing notes, requires close attention and careful management, and perhaps particularly important is the raising of the seedlings in the warm frames. The "topping," "suckering," and harvesting involve a considerable amount of labour, but the stripping and any artificial drying given can be done at slack times during winter.

In the Kent experiments careful records were kept of the labour and expense involved, and the detailed estimate of the total cost in 1911 was as follows:—

A.—Cost of Raising 15,000 Seedling Plants.

	£	*s.*	*d.*
Cost of three garden frames (9 sashes) £6. These will last ten years = 12*s.* per annum. In addition 7*s.* may be allowed for painting	0	19	0
9 loads of manure at 5*s.* per load = 45*s.*, less 22*s.* for residual value	1	3	0
Watering, ventilating, weeding, thinning out	0	10	0
Cost of seed : ¼ ounce at 1*s.* 8*d.*	0	0	5
Cost of sowing	0	1	0
Total, say	£2	13	6

B.—Cost of the Crop.

	£	*s.*	*d.*
Rent, rates, and taxes	2	0	0
Cultivations previous to planting, as for cabbages	1	10	0
Twenty loads farmyard manure at 5*s.*	5	0	0
Complete artificial manures	2	10	0
Cost of the seedlings (see above)	2	13	6
Planting out the seedlings	1	10	0
Three waterings of seedlings	1	10	0
Inter-culture : two horse hoeings, three hand hoeings	1	0	0
Disbudding : four times at 10*s.* 6*d.*	2	2	0
Topping...	0	5	0
Cutting : one man (4*d.*) and two boys (2*d.*) 200 plants in one hour ; 9,650 plants in forty-eight hours	2	8	0
1,000 curing sticks : £2 10*s.* These would last three years ...	0	17	0
3,000 yards binder twine : 20 lb. at 4*d.*	0	7	0
Erection of scaffolding...	0	10	0
Carting up to farmstead (½ mile) and storing	0	15	0
Stripping off the leaves	1	15	0
Cost of artificial shelters		—	
Cost of extracting the nicotine	0	10	0
Cost per acre	£27	2	6

In experiments carried out in Ireland in 1910 the estimated total cost per acre was £18 13*s.* 5*d.*, and with experience of the crop and labour accustomed to deal with it, probably the estimate of £27 would prove too high.

In 1911 in Kent several plots yielded well over 2,000 lb. of dry leaves, and over 150 lb. of nicotine per acre. The percentage of nicotine obtained in that year was, however, probably exceptionally high as a result of the abnormal summer, but it will be seen that if even only half the quantity is obtained, the nicotine is produced at a considerably less cost than its market price.

The crop is, of course, only in its experimental stage as yet, and in addition to the cost of cultivation the effect of the restrictions and regulations imposed by the Commissioners of Customs and Excise has to be taken into account.

LIME-SULPHUR WASH FOR AMERICAN GOOSEBERRY MILDEW (*Sphærotheca mors-uvæ*).

E. S. SALMON, F.L.S., *Mycologist, South-Eastern Agricultural College, Wye;* and C. W. B. WRIGHT.

IN this *Journal* for May, 1912, an account was given of some experiments carried out during 1911 at the South-Eastern Agricultural College, Wye, Kent, with the object of ascertaining at what strength (specific gravity) the lime-sulphur wash can be used on the foliage of the gooseberry, without causing injury. The general conclusions arrived at were summarised as follows:—

"(1) It appears safe, under any weather conditions, to spray 'Whinham's Industry' with the lime-sulphur wash at 1·005 sp. gr. Probably it is safe under most weather conditions to spray this variety with the wash at 1·01 sp. gr.

"(2) It is unsafe, during very hot weather, or if very hot weather is expected, to spray 'Berry's Early' (and probably 'Yellow Rough') with the wash at 1·005 sp. gr. (or even at a lower concentration), as serious defoliation will result.

"(3) In dull, warm weather, and in sunny weather if it is not exceptionally hot, it appears safe to spray 'Berry's Early' with the lime-sulphur wash at 1·005 sp. gr., as only very slight defoliation will result."

In the same article the advantages of the lime-sulphur wash, as a sulphur wash which is not readily washed off by rain, were pointed out, and reference may be made to this article for information on this point, particularly in connection with the control of American gooseberry mildew. The prediction that, as a factory-made concentrated lime-sulphur wash at a guaranteed specific gravity was being placed on the English market by firms of repute, this wash would be given an extensive trial, has proved correct; inquiries have been and are being constantly received from growers asking for advice as to the use of the lime-sulphur wash on gooseberries.

During the season of 1912 further experiments were carried out. These experiments—as can be seen by the details given below—show very clearly that the different varieties of gooseberries cultivated commercially in this country differ to a marked degree as regards their susceptibility to injury from the lime-sulphur wash; further, that on certain varieties it is possible to use the wash at a strength (specific gravity) sufficient to prevent the attacks of American Gooseberry-mildew without injury to foliage.

The experiments in 1912 were carried out on certain fruit-farms in the Swanley district, North Kent, through the courtesy of Messrs. Wood, Staples, Langlands and Conford. The actual spraying was carried out by Mr. C. W. B. Wright; in all, 1,015 bushes of nine different varieties of gooseberries were sprayed. The Vermorel "Éclair" knapsack sprayer was used, with a nozzle giving a very fine "misty" spray. In every instance the bush was sprayed thoroughly—in the case of the larger bushes about 3 gallons of wash were used for 20 bushes; in the case of the smaller bushes 3 gallons sufficed for 50 bushes. It will be most convenient to record the results obtained under each variety of gooseberry.

Warrington.—The bushes used were old, and consequently produced little fresh growth; they were growing under standard apple trees and were thus to some extent shaded. The lime-sulphur wash was used at 1·01 sp. gr. The first spraying was given on April 29th, when 20 bushes were sprayed. There was no injury noticeable when the bushes were examined on May 6th and May 11th. The same bushes were sprayed a second time on May 11th. There was again no injury, and the bushes were sprayed for the third time on May 25th, with the same result. During all this period the weather was very dry; there was no hot sunshine, the sky being usually overcast.

The experiment was repeated with 20 fresh bushes of the same variety, spraying being carried out three times—on June 17th, June 28th, and July 12th—with the wash at the same strength. The object of this experiment was to ascertain if susceptibility to injury varied at different times in the season. No injury was caused, although a spell of very hot weather occurred at this time.

It seems safe to conclude that Warringtons, when the bushes are old and in a somewhat shaded position, may be sprayed from May to July, under ordinary summer conditions, with the 1·01 wash without fear of injury to the foliage, even when three sprayings are given.

Valentine's Seedling.—These bushes were similarly situated to the Warringtons, under standard plum trees. A lime-sulphur wash of the same strength (1·01 sp. gr.) was applied on the same day, viz., April 29th—10 bushes being sprayed. When the bushes were examined on May 6th and May 11th, only a very slight leaf-fall had occurred; there was no appreciable damage caused at this date. A second spraying of the bushes was given on May 11th; and when the bushes were examined on May 18th it was found that a considerable leaf-fall had occurred. The bushes were sprayed a third time on May 25th; when examined on June 1st it was found that the damage (in the form of leaf-fall) was so considerable that it was considered inadvisable to continue using the wash at 1·01 sp. gr.

On June 17th 10 fresh bushes were sprayed with the wash at 1·005 sp. gr. A marked leaf-fall resulted, the injury produced being greater than that caused in May by the wash at 1·01 sp. gr. A second spraying was given on June 28th; so much injury (in the form of leaf-fall) resulted that it was decided to discontinue the use of the wash at 1·005 sp. gr.

An experiment with the wash at 1·0025 sp. gr. was carried out on July 12th, when 10 further bushes were sprayed. When examined on July 26th, these bushes were found to be so injured as to be almost defoliated. The weather during this time was very hot.

It would appear that Valentine's Seedling exhibits considerable susceptibility to injury from the lime-sulphur wash, and that this susceptibility increases in a marked manner during the season. It is doubtful if, after the middle of May, the lime-sulphur wash can be used with safety on this variety.

Whinham's Industry.—The bushes used were similarly situated to the two preceding varieties, and were sprayed under the same conditions. A control experiment was also carried out with bushes in a sunny position. In each case 20 bushes were sprayed with the 1·01 sp. gr. wash three times, viz., on April 29th, May 11th, and May 25th. No injury resulted in any case.

The experiment with the bushes in a sunny position was repeated later in the season, 20 fresh bushes being sprayed with the 1·01 sp. gr. wash three times, viz., on June 17th, June 28th, and July 12th. No injury resulted. In order to test still further the non-susceptibility of this variety to spray-injury, the same 20 bushes were sprayed a fourth time on July 26th, and again no damage was caused.

It appears, therefore, that under ordinary summer weather conditions, Whinham's Industry may be repeatedly sprayed throughout the season with the 1·01 sp. gr. wash without fear of injury.

Lancashire Lad.—As this variety is probably the one grown to the greatest extent in North Kent, it was considered advisable to test its susceptibility to injury by spraying under different conditions.

In the first experiment the 20 bushes, about four years old and not very robust, were in a shaded position; the wash was used at 1·01 sp. gr. The first spraying was given on April 29th, and the bushes when subsequently examined showed no appreciable injury. The bushes were again sprayed on May 11th; it was found later that the wash had clearly had an injurious effect, as a considerable number of leaves were turned yellow, and some of these fell. A third spraying was given to the bushes on May 25th; this time the injury resulting was so great that further spraying of this variety with the 1·01 sp. gr. was discontinued.

In another experiment carried on during May and June only one spraying with the 1·01 sp. gr. wash was given to the bushes. The bushes used were healthy, about five years old, and situated in a shaded position. No injury followed any of the sprayings, while, as noted above, bushes (slightly younger and not so robust) were almost defoliated after three sprayings. It was also noticed that two bushes, growing among another variety in a sunny situation, were similarly almost defoliated after one spraying with the 1·01 sp. gr. wash at this time of year.

In a further experiment the bushes, which were about five years old, were situated in a sunny position. The 1·005 sp. gr. wash was used. The first spraying was given to 20 bushes on June 17th, in dull weather; the bushes were sprayed again on June 28th, in bright sunshine, and for the third time on July 12th, also in bright sunshine. Some damage was noticeable, in the form of a slight leaf-fall, after the first spraying, but the control bushes were found to be losing their leaves to the same extent. No further leaf-fall occurred after the second or third sprayings.

It seems safe to conclude that Lancashire Lad may be sprayed with the 1·005 sp. gr. wash under ordinary summer conditions; and that probably a single spraying with the 1·01 sp. gr. wash may safely be given early in the season and when the bushes are shaded.

Berry's Early.—As in previous experiments * this variety had shown a marked susceptibility to spray injury, the wash was used first at 1·005 sp. gr. In the first experiment 20 large bushes, from ten to fifteen years old, were sprayed; all but two of these bushes were in a shaded position. The first spraying was given on April 29th, and no injury resulted except on the two bushes in a sunny position, which lost a considerable number of leaves. A second spraying was given these 20 bushes on May 11th, and a third spraying on May 25th. No injury resulted, except on the two bushes in the sunny position, which continued to show a leaf-fall.

---

* *Journal*, May, 1912, p. 101.

In the next experiment the bushes, which were about five years old, were situated in a sunny position. Twenty bushes were sprayed on June 17th with the 1·005 wash. The sprayed bushes subsequently showed a slight leaf-fall, but it was found that the control bushes had also dropped some of their leaves—just as had happened with the Lancashire Lads at the same time of year (see above). The 20 bushes were again sprayed on June 28th, and a more pronounced leaf-fall was caused, the leaf-fall from the sprayed bushes being decidedly greater than that from the unsprayed "control" bushes. The same 20 bushes were sprayed a third time on July 12th, and a week later the leaf-fall had been so considerable that the bushes were now almost defoliated.

On July 26th another experiment was started; 20 fresh bushes in a sunny position were sprayed with the 1·0025 sp. gr. wash. The leaf-fall resulting was again considerable.

It may be concluded that early in the season bushes of Berry's Early growing in somewhat shaded positions may safely be sprayed with the 1·005 sp. gr. wash; it is certain, however, that later in the season, and under certain weather conditions, the wash at this, and even at a lower concentration, will cause serious injury.

Crown Bob.—These bushes, which were old, were situated in a sunny position. In the first experiment 20 bushes were sprayed three times with the 1·01 sp. gr. wash; the spraying was done on April 29th, May 11th, and May 25th. A few bushes here and there dropped a few leaves, but the injury caused by the three sprayings was not appreciable.

The experiment was repeated on June 17th and June 28th. After the second spraying a very considerable leaf-fall occurred, but, contrary to usual experience, not until the tenth day after the spraying; on the ninth day a thunderstorm occurred, followed by hot sunshine, and the next day the bushes were found to be nearly defoliated.

A fresh experiment was carried out, using the 1·005 sp. gr. wash. The bushes, 20 in number, were sprayed on July 12th and again on July 26th. Although the spraying caused a few leaves to fall, the injury resulting was certainly not appreciable.

Although further experiments are necessary to obtain definite information, it appears that quite early in the season the 1·01 sp. gr. wash may be used for Crown Bob, but that later in the season the wash at this strength causes defoliation, and that therefore after May or early June the 1·005 sp. gr. wash should be used.

Rifleman.—The 20 bushes sprayed with the 1·01 sp. gr. wash were old, and were situated in a sunny position, and the first spraying was given on April 29th. The bushes were again sprayed on May 11th and on May 26th, but all remained absolutely unaffected by the spray. The experiment was repeated with 20 fresh bushes, which were sprayed on June 17th, June 28, and July 12th, and the result was the same.

It may therefore be concluded that old bushes of Rifleman can safely be sprayed at least three times with the 1·01 sp. gr. wash throughout the summer; it has yet to be proved whether young actively-growing bushes show the same non-susceptibility.

Yellow Rough.—As this variety had previously been found to be susceptible to spray-injury,* the wash was used at 1·005 sp. gr. in the first series of experiments. All the bushes used were in a shaded position, and in each experiment most of the bushes were fully-grown, ten to fifteen years old, while a few were young, about four years' old. Ten bushes were sprayed on May 1st, and a considerable leaf-fall resulted. These bushes were again sprayed on May 11th, and on May 18th the injury was found to be so severe that it was obviously useless to continue using the wash at this concentration.

In the second experiment five fresh bushes were sprayed with the 1·0025 sp. gr. wash on June 28th, and on July 5th no injury was noticeable; but on July 12th the bushes were found to be almost defoliated.

A third experiment was then carried out, using the wash at 1·001 sp. gr. Five fresh bushes were sprayed on July 26th, and again a marked leaf-fall resulted.

It is clear, therefore, that Yellow Rough, even when growing in a shaded position, is very susceptible to injury from the Lime-Sulphur wash. As early in the season as May this wash cannot be used at "half-strength" (1·005 sp. gr.) without causing serious injury. Later in the season the wash at 1·001 sp. gr. is decidedly injurious. The lime-sulphur wash, in its present commercial form, must therefore be considered as entirely unsuitable for such varieties as Yellow Rough.

---

* *Journal,* May, 1912, pp. 100 and 104.

May Duke.—With this variety an opportunity was obtained of testing both its susceptibility to spray-injury from lime-sulphur, and the value of this wash in preventing the spread of American gooseberry mildew. The 20 bushes sprayed, about seven years old, were situated in a single row under standard apple-trees, and were rather densely shaded. On either side of the row and at one end was a plantation of exactly similar bushes, and at the time of the beginning of the experiment all the bushes were more or less affected with the winter stage of the American gooseberry mildew, which had severely attacked the whole plantation the previous summer. The object of the experiment was to ascertain if it was possible, by the use of lime-sulphur at a strength not injurious to the foliage, to keep these 20 bushes free from the mildew. The conditions—viz., the crowded position of vigorously growing bushes in a shaded position, with the consequent comparative lack of ventilation—were such as to favour the rapid spread of the mildew when it appeared. The wash used was of 1·01 sp. gr. The first spraying was given on May 1st, the second on May 11th, the third on May 25th. No injury was produced. After the third spraying American gooseberry mildew appeared on bushes in several adjacent rows of the surrounding plantation. The berries were picked from the bushes in the infested parts of the plantation on June 1st, and it was estimated that one-sixth part of the crop was more or less affected with the mildew. No mildew appeared on the berries of the sprayed bushes. The bushes were sprayed for the fourth time on June 12th, when there was still no sign of mildew on them. A fifth spraying was given on June 28th, on which date two leaves were found on a bush in the sprayed row with the mildew just beginning to develop, these leaves being on the tips of shoots which had grown away from the sprayed part. All the 20 bushes in the row were sprayed for the sixth time on July 12th—at which date no mildew could be found on them. The sprayed bushes were kept under observation throughout August, and no further spraying was necessary. At the end of August the sprayed bushes were all entirely free from American gooseberry mildew, while the bushes in the contiguous and adjacent rows, and throughout the plantation generally, were plentifully infested along the young shoots with the brown "winter-stage" of the mildew, in spite of the fact that these bushes had been "tipped" three times.

In order to determine if bushes of this variety might safely be sprayed when in a sunny position, 20 bushes so situated were sprayed three times in the sunshine, viz., on June 17th, June 28th, and July 12th, the 1·01 sp. gr. wash being used. There was no leaf-fall or other injury.

It is clear, therefore, that May Duke can safely be sprayed with the 1·01 sp. gr. wash, even when six consecutive sprayings are given. Further, the experiments show that under cultural conditions — closely-planted vigorously-growing bushes in a shaded and shut-in position—and under weather conditions favourable to the spread of the American gooseberry mildew (such as obtained during the summer of 1912), the lime-sulphur wash at 1·01 sp. gr. is able to protect bushes from the spread of the disease.

Some further points of great practical importance have still to be determined. Firstly, how many sprayings are necessary in order to prevent infection with the American mildew and the formation of any "winter-stage" on the shoots; also, if six sprayings are necessary, is the cost prohibitive for commercial purposes? With regard to the first point, the number of sprayings necessary will be to a large extent determined by the vigour of growth of the bush; as long as fresh shoots are being formed, sprayings at intervals of about ten to fourteen days must be given to prevent these shoots from becoming infected—the assumption being made that the bushes are exposed to infection from air-borne spores (*conidia*) produced in neighbouring plantations. In this connection it must be pointed out that the bushes should be sprayed (as in the above experiment) *before* any infection by "winter-spores" (*ascospores*) has taken place; the first spraying should therefore be given early in May. Owing to the cheapness of the lime-sulphur wash, and the ease of application, there seems little doubt that even if six sprayings are necessary the cost of the treatment will not be an excessive charge on the profits of a well-kept gooseberry plantation.

Another most important point to be considered is the effect of the spray in preventing the marketing of the berries. The lime-sulphur wash after exposure to the air deposits a conspicuous whitish dust-like powder over the sprayed parts; this consists of very minute particles of sulphur, which are remarkably adhesive and are not readily washed off by rain or dew. The fruit on recently sprayed bushes cannot therefore be marketed.

An important fact observed last year in connection with the susceptibility of the berry has, however, to be considered here. It was found that at a certain stage of development the fruit of *Cousin's Seedling* (*Sandwich Yellow*) becomes immune to attacks of the mildew. In the cases observed, an attack of mildew was noticed on the bushes of a plantation of this variety at the time when the berries were about half-developed. All the bushes were gone over by hand, and every mildewed berry gathered and destroyed. These mildewed berries formed perhaps 5 per cent. of the crop. Although subsequently the mildew increased noticeably on the young shoots during the following weeks, the developing berries left on the bushes proved quite resistant and when ripe showed no mildew. The fact of this immunity of the berry to mildew at a certain stage of growth suggests that, with some late-ripening varieties, such as *Cousin's Seedling,* it may prove profitable to spray infested bushes with lime-sulphur during the short time when the young berries are susceptible, and then leave off spraying during the comparatively long time when the berries, now immune, are gradually ripening—in which case the amount of spray to be found on the fruit when ready for market would be negligible.

In cases where valuable plantations of choice varieties of gooseberries have become badly infested with the mildew, it might prove worth while to sacrifice the crop for one year if the measures taken ensured that the disease would be practically eradicated—always supposing that no danger exists of such plantations being re-infected the next season from an outside source.

Conclusions.—Different varieties of gooseberries differ to a marked degree as regards the susceptibility of the foliage to injury from the lime-sulphur wash. It is possible with some varieties, *e.g.*, May Duke, to spray repeatedly throughout the season with lime-sulphur, at a strength (1·01 sp. gr.) sufficient to prevent the attacks of American gooseberry mildew, without causing any injury to the foliage. It seems probable that, at least with some varieties, the young foliage at the beginning of the season (May) will prove resistant to injury from the lime-sulphur wash, while showing susceptibility later in the season. This is important from the practical standpoint of keeping down the disease, since it is during May and early June that spraying will prove most efficacious in preventing the first infection in the season by germinating "winter-spores" (*ascospores*) and the rapid spread of the mildew by the first-formed "summer-spores" (*conidia*).* Under ordinary summer weather conditions the "strength" of the lime-sulphur wash should be as follows:—

For *Whinham's Industry, Rifleman, Warrington,* and *May Duke:* 1·01 sp. gr.

For *Lancashire Lad:* 1·005 sp. gr.

For *Crown Bob:* 1·005 sp. gr. early in the season; later in the season some injury may be caused.

For *Berry's Early:* 1·005 sp. gr. early in the season and when the bushes are more or less shaded; later in the season injury is caused by the wash at this, and at lower, concentration.

For *Valentine's Seedling* and *Yellow Rough:* these varieties show so marked a susceptibility to injury that they cannot safely be sprayed with lime-sulphur.

For the present—until further experiments have been carried out—the "half-strength" wash (1·005 sp. gr.) should be used (except where indicated above) and the spraying done on an experimental scale.

---

* A fully illustrated Leaflet giving the life-history of the American Gooseberry Mildew can be obtained free on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

"YELLOW RATTLE," AS A WEED ON ARABLE LAND.

WINIFRED E. BRENCHLEY, D.Sc., F.L.S.
Rothamsted Experimental Station.

UNDER the name "Yellow Rattle" two distinct species of plants are included, *Rhinanthus minor* and *Rhinanthus major*,* though they are often treated as the one species, *R. Crista-galli.* They are members of the Natural Order *Scrophulariaceæ*, and bear pairs of rather yellowish-green leaves and bright yellow flowers (Fig. 1), which give place to inflated membranous fruits within which the ripe seeds rattle, so giving rise to the local names of "Yellow Rattle," or "Rattle Basket." The smaller plant, *R. minor*, is the more frequently seen, and occurs on pasture lands in various parts of the country, but unless it is present in very great quantities little notice is taken of it, as farmers do not seem to consider that it does much damage. *R. major*, on the other hand, appears occasionally on arable land, and is a serious pest. A field at Heytesbury, Wilts, may be cited as an instance of this. In some years Yellow Rattle is present in such great abundance that it absolutely destroys the barley crop in large patches, doing great damage in a forty-acre field. In 1911 many of the barley plants were not more than three inches high, and even where a fairly decent plant had managed to grow the ears failed to form, so that no crop resulted. From an inspection of the field one would have been justified in thinking that the Rattle was the sown crop, as it was far more luxuriant than the barley.

Life History.—The reason that the Yellow Rattle is so pernicious is that it is of a parasitic nature, *i.e.*, instead of taking its food direct from the soil by means of its roots, it lives at the expense of other plants known as "hosts," from which it steals food, so causing them to suffer from malnutrition owing to the diverting of so much of their nutriment into the parasite. The Yellow Rattle is chiefly found parasitic on the roots of various grasses and cereals, but it is also able to live quite well on the roots of plants belonging to such orders as *Umbelliferæ* and *Compositæ*. Several members of the *Scrophulariaceæ* are parasites (all belonging to the sub-family *Rhinanthoideæ*), and they were recognised as such many years ago. Cultivators had long noticed that these plants were capable of doing harm to other plants, and in 1847 Decaisne

---

* An account of Yellow Rattle, with a Coloured Plate, was published in the *Journal*, Vol. xv, May, 1908, p. 115; and an illustrated account is also given in Leaflet No. 251.

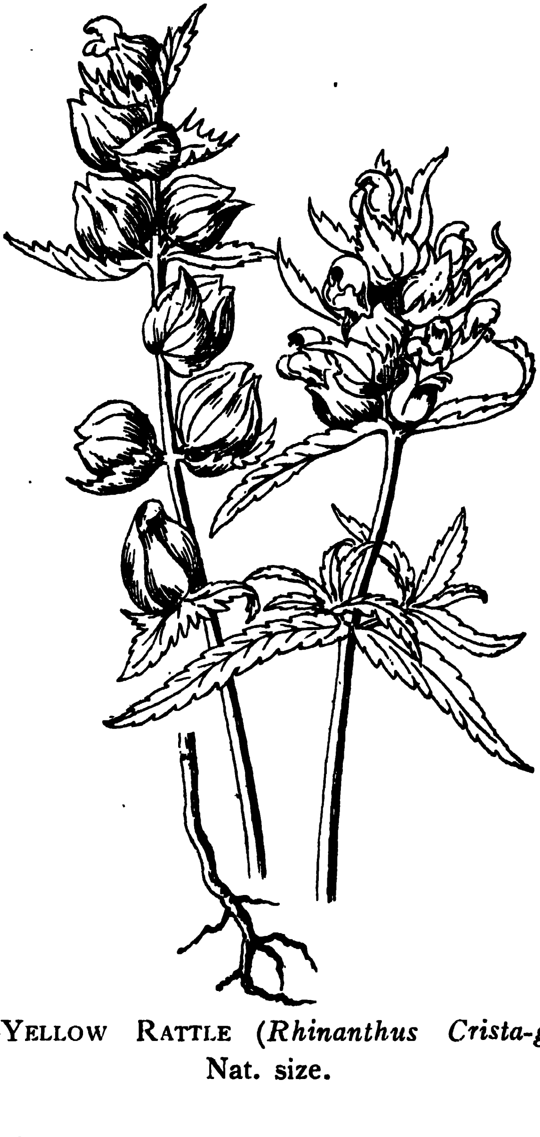


FIG. 1.—YELLOW RATTLE (*Rhinanthus Crista-galli*, L.). Nat. size.

first stated that this fact was in all probability due to the parasitic nature of the plants.

Rhinanthus is enabled to rob its "host" by means of special organs known as suckers, which are developed on the roots. The roots of the parasite and host grow close together in the soil, and at the points of contact little swellings or pads appear on the *Rhinanthus* root (Fig. 2). The cells composing the outer layer of the Rattle root begin to elongate just where the swelling or pad occurs, and they force their way into the root of the host, acting as absorbing organs, breaking down the tissues, and so enabling the sucker to penetrate right into the heart of the host root. When once the connection is firmly established the sucker begins to steal food from the host and to transfer it to the roots of the Yellow Rattle, whence it is passed on to other parts of the plant.

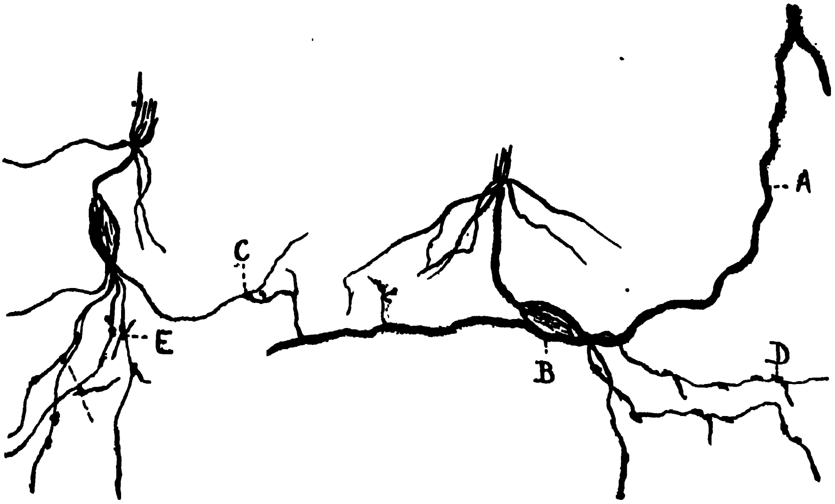


FIG. 2.—SKETCH SHOWING ATTACHMENT OF ONE *Rhinanthus* ROOT TO TWO BARLEY PLANTS.

A. Main root of *Rhinanthus*.
B. Attachment of main root of *Rhinanthus* to husk of Barley.
C. Attachment of smaller root of *Rhinanthus* to a second Barley plant.
D. E. Suckers of *Rhinanthus* on small root of Barley, with detached bits of *Rhinanthus* root adhering.

Although the suckers of the Yellow Rattle usually attach themselves to the small rootlets of the host, yet sometimes in barley they may be found fixed to the lower parts of the stem beneath the surface of the soil. In one instance observed the *Rhinanthus* root was in close proximity to the husk of the barley "seed," to which it had fastened itself, apparently by a row of suckers (Fig. 2, B).

Remedial Measures.—This consideration of its life history explains the reason why Yellow Rattle is able to do so much damage to crops if it occurs in any quantity. Not only does it rob the crop of its nutriment, so hindering development, but in some cases it tends to kill the roots of its host plant, thus aggravating the evil. When it appears in a crop special care should be devoted to its eradication. If it is among the cereals, ordinary hoeing and weeding are useless, because the parasite is so firmly attached to its host that in pulling up the weed there is danger of injury to the crop root, as the suckers are inseparably attached. If, unhappily, a piece of arable land becomes badly infested with Yellow Rattle, the only remedy which seems feasible and effectual is that of fallowing and constant cultivation. If the land is cropped with cereals the weed ripens and sheds its seeds before the crop is cut, and so the mischief is increased. If, however, the land is fallowed for a year and ploughed three or four times, many of the *Rhinanthus* seeds will germinate after the first ploughing, and the young plants will be cut down the next time; at the second ploughing the deeper lying seeds will be brought to the surface, to start into growth and be cut down in their turn. Mere cultivation with the harrow after the first ploughing would probably not meet the case, as the deeply buried seeds would retain their vitality and spring into activity when the land is ploughed up to receive the crop after the fallow. In all probability it would be wise in any case to follow up the fallowing and ploughing with a root crop, as this provides plenty of opportunity for cleaning the land, and also does not furnish a suitable host for the parasite. It may also be suggested that in special cases where the weed is known as a troublesome pest in one particular crop (*e.g.*, on barley at Heytesbury), it would be advisable not to plant that crop on the field for a few years, if practicable, in order to avoid giving the parasite any chance to reassert itself. On pasture land, too, care should be taken, where possible, not to allow the Yellow Rattle to ripen and shed its seed, as it may be more harmful than seems apparent, and the plant is always apt to spread.

INSURANCE AGAINST DAMAGE TO CROPS BY HAILSTORMS.

A CIRCULAR letter was recently addressed by the Board of Agriculture and Fisheries to their Honorary Agricultural Correspondents in England and Wales, asking for information as to the amount of damage done to crops in this country by hailstorms, and as to the measures adopted in regard to insurance against loss occasioned thereby.

From the replies received by the Board it would appear that insurance against hailstorms is not at all common amongst the farmers of this country, and that, except in certain districts, the risk of any serious loss is considered to be, if not altogether negligible, at all events so remote as not to be worth insuring against. According to the observations of one of the few insurance companies which accept this class of business, the area in which destructive hailstorms occur comprises less than 7 per cent. of the area of the United Kingdom.

Hail insurance may now be said to be fairly general in only two counties, namely, Bedfordshire and Huntingdonshire. Its prevalence in these two counties may be accounted for by the fact that the most destructive hailstorm in recent years occurred in North Bedfordshire and Huntingdonshire in August, 1906, when the damage was estimated at between £20,000 and £30,000. These two counties, together with parts of Cambridgeshire and Northamptonshire, appear to suffer more from hail than do any other part of the kingdom, and a certain appreciable amount of loss is apparently experienced in this district every summer.

In addition to the four counties mentioned, other counties in which a certain amount of damage is occasionally suffered, and in which a small amount of hail insurance is effected, are Berkshire, Essex, Gloucestershire, Hertfordshire, Leicestershire, Lincolnshire, Norfolk, Oxfordshire, Rutland, Suffolk, Sussex, Wiltshire, and parts of Yorkshire.

In the remaining counties the damage done is almost negligible and the amount of insurance effected practically nil (see Fig. 1).

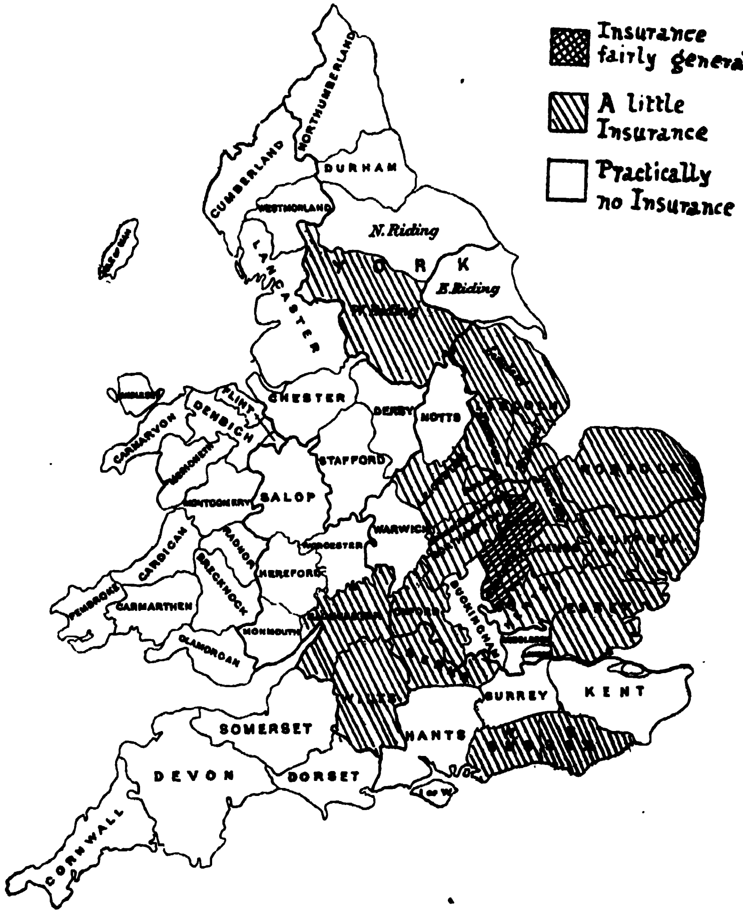


FIG. 1.—This map shows the prevalence of insurance against hail in the different counties of England and Wales.

One or two correspondents in hop-growing districts, however, mention that damage to hops by hail is not unknown, and say that insurance against such loss might have been welcomed, but that no insurance companies would quote rates for this crop.

Premiums charged by six Insurance Companies for the Insurance of various Crops against Hail.

ORDINARY FARM CROPS.

Crop.	Premium per acre (Five Companies) s. d.	Rate per £100 Value of Crop (Ordinary Districts) (One Company). s. d.
Wheat	0 6	7 6
Barley	0 6	7 6
Oats	0 6	7 6
Rye	0 6	7 6
Straw	0 6	3 9
Vetches or Tares ...	0 6	—
Turnips	0 6	7 6
Rye-grass	0 6	—
Clover	0 6	—
Cow Cabbages ...	0 6	—
Carrots	0 6	—
Kohl Rabi	0 6	—
Thousand-headed Kale	0 6	—
Sainfoin	0 6	—
Beet	1 0	10 0
Mangold	1 0	10 0
*Beans (Spring or Winter only) compensation not to exceed—		13 0
30s. per quarter ...	1 6	
40s. ,, ...	2 6	
*Beans (Long Pod or Windsor for Harvesting) value up to contract price, if any, otherwise up to the average price in the neighbourhood, but in neither case to exceed 40s. per quarter	2 6	
*Peas (to be harvested) compensation not to exceed—		13 0
30s. per quarter ...	1 6	
40s. ,, ...	2 6	
50s. ,, ...	3 0	
60s. ,, ...	3 6	
*Peas (to be pulled green) Company's liability not to exceed £12 per acre .	3 6	
Beans and Vetches mixed	1 0	—
Potatoes (for consumption) Value up to £25 per acre ...	5 0	20 0
Flax (fibre only) ..	2 0	—
Buckwheat	2 6	—

SPECIAL CROPS GROWN FOR SEED.

Crop.	Premium per acre (Five Companies) s. d.	Rate per £100 Value of Crop (Ordinary Districts). (One Company). s. d.
Alsike	1 6	—
Beet	15 0	40 0
Canary	5 0	—
Carraway	5 0	—
Carrot	15 0	40 0
Clover	1 6	15 0
Cole or Rape ...	10 0	—
Flax (grown for Seed and Fibre).	5 0	—
Flax (grown for Seed only)... ...	3 6	—
Kohl Rabi	15 0	—
Mangolds	15 0	40 0
Mustard	15 0	40 0
Parsley	5 0	—
Rye-grass	3 6	30 0
Sainfoin	2 6	—
Thousand-headed Kale	20 0	—
Trefoil	1 6	15 0
Trifolium (Crimson Clover)	2 0	—
Turnip	15 0	40 0
Vetches or Tares .	2 0	—
Potatoes— (Value up to £25 per acre)	5 0	—
Ditto £40 per acre	8 0	—
Ditto £60 per acre	12 0	—
Ditto £80 per acre	16 0	—
Ditto £100 per acre	20 0	—

* Beans and Peas are charged special rates unless all the cereal crops on the farm are also insured.

Statement showing Amount of Insurance and Damage Done by Hail in different Counties.

Counties.	Insurance.	Serious Damage by Hailstorms.
ENGLAND.		
Bedford...	General since 1906.	A certain amount every year. £15,000 to £20,000 damage in Aug. 1906.
Berks	Very little.	No serious damage for 25 years.
Buckingham	Nil.	Nil.
Cambridge	Very little.	Serious damage occasionally.
Chester	Nil.	Nil.
Cornwall	Nil.	Nil.
Cumberland	Nil.	Nil.
Derby	Nil.	Damage not unknown.
Devon	Nil.	Nil.
Dorset	Nil.	Nil.
Durham...	Nil.	Only one serious storm in 40 years.
Essex	Very little.	Serious storm 14 years ago.
Gloucester	Very little.	Two or three serious storms in 50 years.
Hants	Nil.	Nil.
Hereford	Nil.	Only one serious storm in 40 years.
Hertford	Very little.	No serious damage in recent years.
Huntingdon	General since 1906.	A certain amount every year. £5,000 to £10,000 damage in Aug. 1906.
Kent	Nil.	Serious storm 8 years ago.
Lancaster	Nil.	No serious damage in 30 years.
Leicester	Very little.	Two serious storms in 40 years.
Lincoln, Holland ..	Very little.	Serious damage occasionally.
,, Kesteven.		
,, Lindsey ..		
London	—	—
Middlesex	Nil.	No serious damage for 15 years.
Monmouth	Nil.	Nil.
Norfolk	Very little.	Serious damage occasionally.
Northampton ..	Very little.	Serious damage occasionally.
Northumberland ...	Nil.	Nil.
Notts	Nil.	Serious storms occasionally.
Oxford	Very little.	One serious storm in 45 years.
Rutland...	Very little.	No serious damage for 10 years.
Salop	Nil.	Serious damage very rare.
Somerset	Nil.	One serious storm in 30 years.
Stafford...	Nil.	Nil.
Suffolk	Very little.	Very little.
Surrey	Nil.	Practically nil.
Sussex	Very little.	Serious storms occasionally.
Warwick	Nil.	No serious damage for 20 years.
Westmorland ...	Nil.	Nil.
Wilts	Very little.	Very little.
Worcester	Nil.	No serious damage for 20 years.
York, East Riding.	Very little.	One serious storm in 40 years.
,, North Riding		
,, West Riding.		
WALES	Nil.	Practically nil.

A map (Fig. 2) showing the number of days on which hail has been reported in July and August at different places in the United Kingdom in the ten years ending 1912 has been kindly prepared for the Board by the Director of the Meteorological Office.

The Board have received the prospectuses of six different insurance companies offering hail insurance policies, and the rates charged by five of them are identical.

The remaining company strikes out a new line, and, instead of charging a uniform premium per acre for the whole country, varies the premium according to the probable risk of loss, estimated from the previous history of the particular district as regards destructive hailstorms.

First-class districts comprise those where no damaging hailstorm has occurred during the growing season for the past ten years. In such districts the premiums charged are 10 *per cent. less* than the rates charged in ordinary districts.

Ordinary districts comprise those where only one damaging hailstorm has occurred during the past ten years.

Hazardous districts are those where *two* damaging hailstorms have occurred during the past ten years. In such districts *one-third more* than the ordinary rate is charged.

Extra-hazardous districts are those where *three* damaging hailstorms have occurred during the past ten years. In those districts *double* the ordinary rate is charged.

This company bases its premiums on the value placed on the total crop by the owner, instead of charging a rate per acre.

A list showing the premiums charged under the two systems for various crops is given (p. 1011), together with a statement summarising for each county the correspondents' opinions of the amounts of insurance effected and damage done by hailstorms (p. 1012).

Farm Schools in France, Germany and Belgium.

In view of the attention which is now being given to the subject of Farm Schools and Institutes, an educational pamphlet recently issued by the Board of Education* is of interest. The author, Mr. R. B. Greig, has had exceptional opportunities of becoming acquainted with the systems of agricultural education adopted on the Continent and in the Colonies; his observations and conclusions are, consequently, entitled to careful consideration.

A large number of schools and colleges were visited by Mr. Greig; they can be classified as follows:—

(*a*) Farm schools situated on farms.

(*b*) Winter and short course schools with no farm.

(*c*) Long course schools with no farm.

(*d*) Secondary schools with an agricultural side and a farm.

(*e*) Schools of practical agriculture with farms.

(*f*) Agricultural colleges.

(*g*) Itinerant instruction and women's institutes.

The first class—farm schools situated on farms—are found in France, Germany, and Belgium.

The author is of opinion that institutions of the type of the French Fermes-Ecoles have no conceivable place in English education, in view of the fact that elementary practical instruction is readily obtained on an ordinary farm; in some parts of Ireland, he thinks, schools of this type might be successful.

The German type of farm school suffers from the grave defect that, in practice, it has not succeeded in attracting the peasant farmer class; it is resorted to by youths who wish to qualify as managers or officials.

In Belgium, however, Mr. Grieg found a school of the first type (Ecole Ménagère) for girls doing useful work. It was one of a number organised for the purpose of instructing women in household management and domestic economy, which have been in successful operation for twenty years.

---

* Report on Farm and Agricultural Schools and Colleges in France, Germany, and Belgium. Board of Education. Educational Pamphlets, No. 25.

The specific subjects taught are laundry work, dairying and poultry keeping, and almost every duty which falls to the lot of a farmer's wife is the subject of instruction and explanation, from the point of view of interest as well as economy.

(*b*) Short course schools with no farm.

An admirable type of this class of school was found in Sweden, near Svalöf. The programme of this school includes a winter session for men and a summer session for women. The school adjoins the well-known Swedish Seed Station, and is in the midst of a district where the farming is of a very high class.

(*c*) Long-course schools with no farm.

As a type of this class of school, the author describes a visit to a German Landwirtschaftsschule at Hildesheim. From this school over 90 per cent. of the students return to practical farming. The technicalities of farming are not taught, only underlying scientific principles are dealt with, and about one half of the time is given to ordinary school subjects.

(*d*) Secondary school with an agricultural side and a farm.

Under this head Mr. Greig describes the Agricultural High School at Ballarat, Australia. The syllabus here also includes ordinary school subjects, and only one-third of the pupils' time is given to agriculture. Manual instruction on the farm and in the workshops is a prominent feature. The opinion in Australia appears to be that a strictly "vocational" curriculum is a mistake.

(*e*) Schools of practical agriculture with farms.

This class includes the French Ecoles Pratiques d'Agriculture, and they do not seem to have been successful in attracting the farming class of student.

The general conclusions of the author may be summarised as follows:—

1. No foreign or Colonial system is suitable for adoption *en bloc* in this country.

Mr. Greig points out that, since the general farm practice—so far as manual processes are concerned—in England and Scotland is superior to that of any other country, education here should be directed to instruction in the methods and systems of farming, and to such subjects as improvement of land, crops, and stock. A school in which a large portion of the time is devoted to instruction in such matters as ploughing, stacking or hedging, is not needed here.

2. Secondary and other schools with an agricultural bias will succeed best where the larger proportion of the pupils intend to follow agriculture; provided that masters with proper qualifications can be obtained, and that no attempt is made to teach the *art* of agriculture.

3. As an ideal organisation Mr. Greig suggests that the best results would be obtained from an institution which combined the following features: (1) A winter school for men; (2) a summer school for women; (3) headquarters of an itinerant staff of instructors; (4) a demonstration centre; and linked thereto (5) a secondary school with an agricultural side.

The author advocates the inclusion—on the French model—of moral and civic teaching in the curriculum of agricultural education, and lays great stress on the need for teaching business methods through instruction in book-keeping.

4. Finally, attention is invited to the advantages of itinerant work, when put into the hands of a really capable instructor.

Report on Grants for Agricultural Education and Research, 1911-12.

The Report of the Board of Agriculture and Fisheries on the Distribution of Grants for Agricultural Education and Research in 1911–12 has recently been issued [Cd. 6601, price 6*d*.]. The grants made during the year to universities, university and agricultural colleges, and other institutions for the purposes of agricultural education amounted to £18,840; this sum, however, includes special grants each of £250 made to three institutions in respect of instruction in forestry. The Board also continued grants made in previous years for experiments and research, and these amounted to £250. In addition, grants were paid for the first time from the Development Fund in aid of agricultural research. These latter grants, which were made, with two exceptions, so as to cover the cost of specific investigations, amounted in all to £9,263. The appendices to the Report contain an account of the work done at each of the institutions aided, together with a summary of the provision made in each county in England and Wales for agricultural education.

In his report of the year Mr. Middleton points out that, in view of the large additional sums which the Development and Road Improvement Funds Act, 1909 and 1910, have provided for agricultural education, Local Education Committees should examine the arrangements made for their work with a view to adapting them, where necessary, to the altered circumstances. The State has now placed, for the first time, a large sum for research at the disposal of British agriculture, and it is clearly the duty both of the Central and Local Authorities to devise means for applying to practical farming the knowledge provided by workers in research institutes. The purpose of the grants made for research is not in this instance to subsidise scientific workers, but to develop agriculture by scientific means, and until the knowledge of the laboratory has been translated into practice in the field the work is incomplete. When reconsidering their educational methods, Local Education Authorities should understand that their aid is expected in securing from the expenditure and labour incurred in agricultural research results of real value. The research institutes endowed by the Development Fund are national, not local institutions. The primary duty of the persons engaged in these institutes is to advance knowledge, and the needs of local agriculture, if they are considered at all, can only be considered incidentally. The result is that if any locality wishes to make use of the research institutes it must take steps to adapt scientific discoveries to its own conditions.

It should further be remembered by those responsible for the education of agriculturists that not only are the results of the work of all the new research institutes to be available for agriculturists in any county, but as a consequence of the establishment of research institutes in England this country may now draw upon the results obtained by the investigators of all other countries in a way that was formerly impossible. There has thus been created a system for bringing within reach of English agriculture the knowledge resulting from the vast amount of work now undertaken in the research laboratories of all civilised countries. But all this knowledge will be valueless to any particular locality until it has been applied by farmers to the cultivation of their land. How is this application of scientific discoveries to the commercial questions of the ordinary farm to be accomplished? Can farmers be expected to study scientific treatises? If farmers did study and understand the publications of research stations could they afford the time and the cost involved by the adaptation of the applications of new principles to the particular circumstances of their own farms?

If answers to such questions as the foregoing are attempted it will be agreed that the Development and Road Improvement Funds Acts have added new responsibility to the work of Local Education Authorities, or at least that a duty which was formerly inconsiderable has now become important. The only important task of a local committee charged with agricultural education has hitherto been to provide for the instruction of young persons up to the time when they leave school or college, or to supply itinerant teachers capable, as a rule, of instructing novices only; they are now expected to make the provision required for advising experienced farmers on the means to be adopted in applying scientific discoveries to practice—a difficult and responsible task.

In view then of the provision now made by the State for research, of the importance of securing for each county the fullest benefit from results available for all, and of the need for caution in introducing new methods, Local Education Authorities should consider the nature and qualifications of the local staff required. For spreading a knowledge of practices which have been shown to be improved practices, instructors with a good practical knowledge of some branch of agriculture are wanted. The number at present available is small, but the requirements are already known and well defined. Local Education Authorities need experience no great difficulty in securing suitable men for this particular type of work after the supply has had time to adjust itself to the demand. The position as regards the farmer's scientific advisers is, however, different, and for the most part the types have still to be evolved. For the purpose of translating the results of research into successful practice a highly trained scientific man is required having a special knowledge of some particular branch of science and a sufficient acquaintance with agriculture to command the respect of skilful and enlightened practical farmers. Many branches of science bear on agriculture: the research scheme contemplates institutes in eleven subjects, and most of these subjects would provide a field of work for several specialists. It is clear, therefore, that no county could afford to maintain all the specialists who might usefully be engaged in assisting farmers to apply research. For the present all that is practicable is to lay the foundations of a system, having as its object the bringing into existence of a class of well-qualified specialists who shall devote themselves to the service of agriculture. The first essential is that the specialists to be employed should really be specialists; "all-round" men would be of no use for the particular purpose in view. The second essential is that the persons who are to be engaged in the work of promoting agriculture should be of the same calibre as those who have advanced arts like medicine and engineering.

It is obvious from the qualifications required in the men to be employed, that the only practicable way of securing their services will be for groups of counties to associate themselves with collegiate institutions providing laboratories and other facilities for scientific workers, and it is with the object of facilitating combination and of initiating the system of employing specialists recommended above that the Board's Advisory Scheme was drafted. Having regard to the institutions available as centres, the Board arranged the counties of England and Wales in twelve groups or "provinces," and they have obtained a grant of £12,000 per annum from the Development Fund which will be employed in providing certain trained specialists in each area. The grants are made to the governors of the collegiate centres, who, subject to the approval of the Board, select the officers and are responsible for their work. The teaching staffs of most of the institutions selected are already doing some Advisory work, and the officers first selected under the new scheme will be chosen with the view of supplementing the work of the staff already in existence. As the work expands it is expected that additional Advisers will be added to the staff. While these grants are made to the governors of central institutions it should be clearly understood that their object is to place skilled scientific advice at the disposal of farmers resident in the different groups of counties, and in framing their schemes of work Local Education Authorities will be expected to make provision for securing to residents in their administrative areas the benefits of the provision made by the colleges. In particular, local instructors should be directed to apply to the college in all cases in which the assistance of an expert is desirable.*

It will be apparent that while the new system is in its early stages many of the questions submitted to institutions may be on subjects other than those on which the Advisers have expert knowledge; in such case the Advisers would in the first place consult their colleagues on the college staff, and if the necessary advice is not obtainable they would then consult Advisers at other institutions. By linking the collegiate centres together in this way it is intended that a farmer in any particular county should be able, through the centre with which his county is associated, to get the best expert advice on any agricultural question. A further shortcoming inevitable in the working of a new scheme may be noticed. Since no class of agricultural specialist, corresponding to the medical specialist, exists, it will be necessary to train up men for the work, and therefore to employ at the outset young and inexperienced persons. For the first few years the work must suffer from this lack of experience, but just as well-trained young medical men quickly acquire experience so will these specialists who are being trained to help agriculturists.

"White-Heads" or "Take-All" of Wheat and Oats†
(*Ophiobolus graminis*, Sacc.)

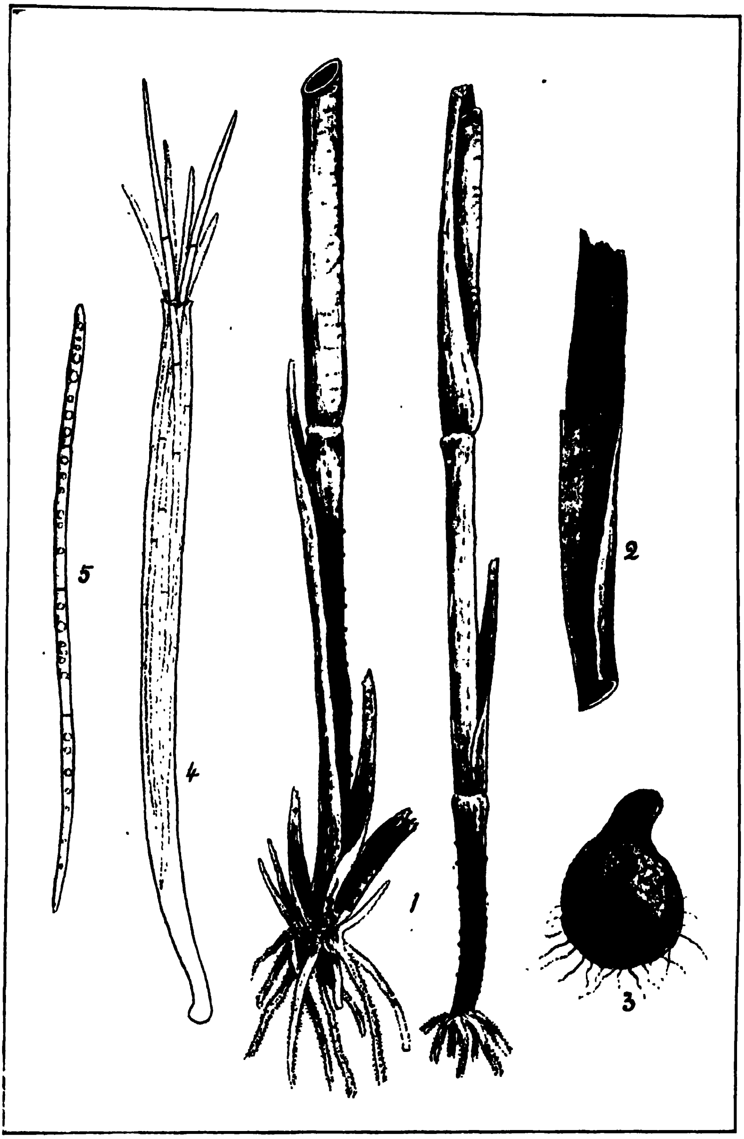
Description of the Disease.—This serious disease presents itself under two very different aspects, depending to a very great extent on the period at which the plants are attacked, and on weather conditions favouring respectively the host plant or the fungus.

In the condition known as "White-heads," the plants usually attain their full growth and the ears are of normal size, but the grain either remains undeveloped, or is very much shrivelled

---

* Information as to the Advisory Centres is given on p. 1026.

† *Kew Bulletin*, No. 10, 1912.



"WHITE-HEADS" OR "TAKE-ALL" OF WHEAT AND OATS

Fig. 1.—The appearance of the fungus at the base of oat plants. Nat. size. Fig. 2.—Fungus on a leaf-sheath. Slightly mag. Fig 3.—Perithecium, or fruit of the fungus. Mag. Fig. 4.—Ascus with spores escaping. Mag. Fig. 5. - Spore. Mag.

and useless. The ears and straw of such diseased plants present a bleached appearance, suggesting at a distance premature ripening, but on examination the entire plant proves to be dry and dead, and two or three inches at the base of the straw presents a blackened appearance, as if it had been charred. If this blackened portion of the straw be examined with a pocket-lens, numerous minute, black, wart-like bodies will be seen, more especially on the inner side of the sheaths encircling the base of the stem. These are the fruits of the fungus causing the disease. This phase of the disease often occurs in more or less definite patches in the field, which show conspicuously at a distance owing to their whitish or bleached appearance, while the healthy part of the crop is still green.

In the condition known as "Take-all," the plants are attacked seriously at an early stage of growth and become yellow, and often die before the stem is formed, or at all events before the ear escapes from its sheath. As in the case of "White-heads" the disease spreads from a centre, and frequently considerable extended patches of such stunted plants may be found. If carefully examined, the base of the plant will be found to present a somewhat blackened appearance. The roots of diseased plants are always very woolly, owing to a dense formation of root-hairs. In many instances a second lot of roots may be formed higher up on the stem of diseased plants, but these in turn are attacked by the fungus, and the plant ultimately succumbs. "White-heads" and "Take-all" were at one time considered as two independent diseases, caused by different organisms, but MacAlpine has proved that the two are caused by a fungus called *Ophiobolus graminis*, Sacc., which is always present at the base of the stem. It is readily recognised by the dark colour of its mycelium, which forms a thin felt on the stem and leaf-sheaths. Infection experiments have proved that this fungus is the direct cause of the disease.

Prevalence of the Disease.—The disease is probably far more prevalent in this country than is generally suspected. Material sent to Kew from time to time, for examination, while highly suggestive of the disease, is invariably cut off at some distance from the ground; consequently that portion of the plant that would afford actual proof of the nature of the disease is absent, and a request for a second batch including the root is but rarely responded to. The fungus was first observed in England by Worthington G. Smith in 1884, and named "Straw blight." It is stated that the loss occasioned ranges from one-half to one-fiftieth of the crop. The disease is also well known in Italy, France, Germany, Belgium, Australia, and the United States, and is in all probability present wherever wheat is cultivated.

The reason why uncertainty as to the cause of the disease has existed so long is due to the fact that the fungus generally produces its fruit during the winter months on the stubble, and hence has escaped observation; for during the period of growth of the wheat the mycelium only of the fungus is present.

Method of Attack.—The spores of the fungus are liberated during the winter or early spring, and remain in the soil until the required amount of moisture and temperature induces germination. According to Mangin,† the spores on germination either directly give origin to a number of colourless, minute, sickle-shaped, secondary spores, or a slender germ-tube is first formed, which bears a cluster of the secondary spores at its tip. From these secondary spores on germination a very delicate germ-tube arises, which enters the wheat plant through the root-hairs. Mangin observed that when 1 per cent. of sulphate of ammonia, or 1 per cent. of phosphate of ammonia was added to the water in which the spores were placed, germination was arrested. After the mycelium has entered the root it gradually extends for three or four inches up the stem, and also passes into the sheaths surrounding the base of the stem. In addition to permeating the tissues, the mycelium also develops on the surface of the stem, and on the inner surface of the sheaths, where it assumes a dark brown colour, and forms a somewhat thick felt that can be scraped off. The minute black fruits may be found nestling in this felt of mycelium; they also occur on the root.

According to McAlpine,* wheat is the only cereal attacked by this fungus in Australia; "the oat grows well in Take-all patches, and is not attacked by the fungus, hence it is recommended for starving it out." This statement, however, does not hold good for this country, as specimens of oat plants attacked by *Ophiobolus graminis* were sent to Kew from Corwen, N. Wales, for determination during the past season. The diseased oats showed the "White-head" phase, with silvery, empty glumes, and the base of the stem and root with a copious development of blackish, superficial mycelium. The fruit of the fungus was present, setting aside all doubt as to the identity of the parasite. The crop in this instance was seriously affected, the diseased plants occurring in scattered patches. A field of wheat near Shere, in Surrey, was also badly attacked by the "White-heads" condition of this disease.

---

* *Diseases of Field and Garden Crops*, p. 69.

† *Compt. rend.*, 127, p. 286; *Bull. Soc. Myc. France*, 15, p. 210.

* *Journ. Dept. Agric. Victoria*, 2, p. 424.

Infection Experiments.—The disease gradually spreads from a centre of infection, which may be due either to the presence of the vegetative mycelium of the fungus in the soil, or to the presence of spores. If a fragment of the dark brown mycelium is placed under favourable conditions for growth, in a hanging-drop, slender colourless threads of mycelium spring from the broken ends of the dark coloured mycelium in about 24 hours; these slender threads grow and ramify very quickly. At the end of a week several such hanging-drop cultures were transferred to a large flask, containing a suitable liquid medium, where they remained for a fortnight, during which time the mycelium continued to increase in quantity, but remained quite colourless and very slender. In the meantime, a mixture of oats and wheat had been sown in a box, divided into two equal parts by a sheet of tin. When the seedlings were about 1 inch high, the contents of the flask containing the mycelium was emptied into a hole in the soil in one of the partitions of the box. Six weeks after the application of the mycelium to the soil, most of the plants, both oats and wheat, were yellow and drooping, and an examination revealed the presence of the characteristic dark-coloured mycelium in the root and passing upwards into the stem. The plants in the uninfected half of the box remained free from disease. An attempt to cause infection of young wheat plants from spores was not successful, but in an experiment described by Mangin, it is stated that the secondary, sickle-shaped spores were sown on wheat seedlings, and at the end of four days germ-tubes were observed piercing the cell-wall of the root-hairs, and entering into the root of the plantlet.

Methods of Prevention.—Land that has grown a diseased crop is certain to be infected, owing to the fact that the fungus is confined to the base of the stem, which is left on the land as stubble and ploughed in. As both the spores and the vegetative mycelium are capable of infecting cereals, prompt preventive measures should be applied without fail. From what has been stated, 1 per cent. of superphosphate of lime, 1 per cent. of sulphate of ammonia, and 1 per cent. of phosphate of ammonia are respectively capable of arresting the growth of the mycelium of the fungus, hence the choice of the particular fungicide resolves itself into questions as to the relative cost of each of the three substances, and also as to which of the three would be most suitable in addition as a fertiliser for a cereal crop. Superphosphate of lime has been definitely proved at Kew to arrest the growth of the fungus, and this material can therefore be recommended, the quantity required being 1½ cwt. per acre. It is important that the dressing should be applied at a time when its activity as a fungicide should be present when the crop is young, as it is during this period that it is most liable to infection. Sulphate of iron has proved effective in Australia, in checking the ravages of "Take-all," 1 cwt. per acre being applied.

The earlier varieties of wheat are said to be most susceptible to the disease, and red wheats, broadly speaking, are least so, but they are not immune.

The fungus also attacks wild grasses, Couch grass (*Agropyrum repens*, Beauv.), *Bromus sterilis*, &c., hence headlands, &c., should be kept clean.

"Blindness," or abortion of the grain in the ear, may be due to other agents than *Ophiobolus graminis*. Much shrivelling of the grain and bleaching or silvering of the inflorescence in cereals and wild grasses is due to the activity of *Thrips cerealium*, Halid. a very minute insect. *Helminthosporium gramineum*, Eriks., the cause of barley leaf-stripe,* also sometimes arrests the development of the grain. In both instances, the absence of blackness at the base of the stem will clearly indicate that *Ophiobolus* is not the cause of injury.

---

* See Leaflet No. 159.

No proper description of *Ophiobolus* appears in any British mycological work, and the following diagnosis should enable the fungus to be recognised:—

Ophiobolus graminis, Sacc. *Perithecia* scattered, blackish, large, subglobose, with a straight or more or less curved neck, 400–500 μ in diameter. *Asci* narrowly cylindric-clavate, 8-spored, 90–125 × 12–13 μ. *Spores* rod-shaped, almost colourless, 70–100 × 3 μ, 3–5–7-septate.

Scheme for Agricultural Research and Technical Advice for Farmers.

The scheme for the promotion of Agricultural Research and the provision of technical advice for farmers in England and Wales, in respect of which the Treasury sanctioned a large annual grant to the Board of Agriculture and Fisheries in August, 1911 (see *Journal*, Vol. XVIII., page 457), has now been in operation for several months, and definite arrangements have been made with a number of institutions which have undertaken to carry out the scheme.

Agricultural Research.—In the case of research, a sum of £31,000 a year is allocated from the Development Fund for the purpose of aiding research into certain definite groups of subjects, the object aimed at being the concentration at one institution, or at institutions working in combination, of the scientific work in each group.

The institutions and the subjects selected are as follows:—

Subject.	Name of Institution.
Plant Physiology	Imperial College of Science.
,, Breeding	Cambridge University.
,, ,, ...	John Innes Institution, Merton, Surrey.
,, Pathology	Royal Botanic Gardens, Kew.
Fruit Growing, including the practical treatment of plant diseases.	Bristol University, in conjunction with the National Fruit and Cider Institute.
Plant Nutrition and Soil Problems	Rothamsted Experimental Station, Harpenden, Herts.
Animal Nutrition	Cambridge University.
,, ,, ...	Leeds University.

Subject.	Name of Institution.
Animal Pathology	Royal Veterinary College.
" "	Veterinary Laboratory of the Board of Agriculture and Fisheries, Alperton, Middlesex.
Dairying	University College, Reading.
Agricultural Zoology, with special reference to Economic Entomology.	Manchester University.
Agricultural Zoology, with special reference to Helminthology.	Birmingham University.
Economics of Agriculture ...	Oxford University.

In addition to research work in fruit-growing to be carried out at Bristol University, arrangements have been made for the establishment of an experimental fruit station in Kent, which will be under the supervision of the South-Eastern Agricultural College, Wye, Kent.

A sum of £3,000 per annum has also been allotted to provide assistance in respect of special investigations for which provision is not otherwise made. A number of such investigations are in progress at various institutions throughout the country.

Advisory Work.—An annual grant of £12,000 per annum was made to the Board to enable them to arrange for the provision of technical advice to farmers, and for the investigation of local agricultural problems.

Many inquiries on agricultural subjects, especially those likely to be made by small holders and others, as regards dairying, poultry-keeping, and gardening, can quite well be dealt with by members of the County Agricultural Staff, but difficulties frequently arise which demand not merely skill and experience in agriculture, but special scientific knowledge and training. In order that assistance of this nature may be available for farmers the Board have arranged with the Agricultural Departments of Universities and University Colleges to supplement the advice given by the County Agricultural Staff. It will be the duty of the Staff of the Institutions, aided by this grant, to devote themselves to the investigation of such local problems, while they will also form a link between the Research Institutions and the farmer.

The Institutions selected up to the present, and the areas in which the services of the staff are available, are as follows:—

Institution.	Area.
Bristol University	Gloucester, Hereford, Somerset, Wiltshire, Worcester.
Cambridge University	Bedford, Cambridge, Essex, Herts, Hunts, Lincoln (Kesteven and Holland), Norfolk, Northampton, Suffolk.
Leeds University	Yorkshire.
Armstrong College, Newcastle ...	Cumberland, Durham, Northumberland, Westmorland.
Reading University College ...	Berkshire, Bucks, Dorset, Hants, Middlesex, Oxford.
South-Eastern Agricultural College, Wye	Kent, Surrey, Sussex.
Aberystwyth, University College of Wales.	Brecknock, Cardigan, Carmarthen, Glamorgan, Merioneth, Monmouth, Montgomery, Pembroke, Radnor.
Bangor, University College of North Wales	Anglesey, Carnarvon, Denbigh, Flint.

At each of the above institutions additions have been made to the agricultural staff in order to carry out the Board's scheme, and special officers have been selected for advisory work. The following is a list of such officers:—

Institution.	Officers.
(1) Bristol University	A. H. Lees, M.A. (*Plant Pathology*). C. T. Gimingham, F.I.C. (*Chemistry*).
(2) Cambridge University... ...	L. F. Newman, B.A. (*Chemistry*). F. R. Petherbridge (*Biology*). R. Beverley (*Agriculture*).
(3) Leeds University	C. Crowther, M.A., Ph.D. (*Chemistry*). T. H. Taylor, M.A. (*Entomology*).
(4) Armstrong College, Newcastle	F. P. Walker, B.Sc. (*Agriculture*). S. H. Collins, M.Sc., F.I.C. (*Chemistry*). T. Anderson (*Botany*). R. A. H. Gray (*Zoology*).
(5) Reading University College...	J. Mackintosh (*Dairy Farming*). J. M. Hector, B.Sc. (*Plant Pathology*).
(6) South-Eastern Agricultural College, Wye	F. V. Theobald, M.A. (*Zoology and Entomology*). E. S. Salmon (*Mycology*).

Institution.	Officers.
(7) Aberystwyth, University College of Wales	R. G. Stapledon, M.A. (*Botany*).
(8) Bangor, University College of North Wales	J. Lloyd Williams, D.Sc. (*Botany*). G. W. Robinson (*Chemistry*).

Agriculturists requiring assistance should write to the Principal or the Secretary of the Institution acting for the area in which they reside, who will arrange for the question to be dealt with by the special Advisory Officer or by another member of the agricultural staff, or, if necessary, will transfer the question to the Research Institution conducting investigations into that particular subject.

Agricultural Holdings Act, 1913.

The object of this Act, which received the Royal Assent on the 14th February, 1913, is to remove the doubts as to the effect of the Agricultural Holdings Act, 1908, in relation to market garden improvements, which were raised by the decision of the Court of Appeal in the case of *In re* Kedwell and Flint.

The effect of that decision was that a tenant from year to year under a contract of tenancy, current on the 1st January, 1896, of a holding which was at that date in use or cultivation as a market garden with the knowledge of the landlord, was not, in the absence of any written agreement that the premises should be let or treated as a market garden, entitled to compensation for improvements executed by him or his predecessors after the earliest day on which, if notice had been given immediately after the 1st January, 1896, the tenancy could have been determined.

The tenancy in that case was a tenancy from year to year determinable on the 11th October in any year by twelve months' notice, and accordingly the right to compensation for market garden improvements was limited to improvements executed before the 11th October, 1897. The effect of the new Act is to remove this limitation.

The terms of this enactment are as follows:—

"For removing doubts as to the effect of subsection (2) of section forty-two of the Agricultural Holdings Act, 1908, and any enactment which is re-enacted by that subsection, it is hereby declared that a tenancy from year to year under a contract of tenancy current on the first day of January, eighteen hundred and ninety-six, shall not be deemed to have been determined thereafter by virtue of any provision contained in section sixty-one of the Agricultural Holdings (England) Act, 1883, and the said subsection shall be repealed from the words ' Provided that ' to the end of the subsection."

The Act applies to any claim for compensation which has not before the 14th February, 1913, been determined by any judgment or order of a court of competent jurisdiction or award or agreement, whether the improvement to which the claim relates was made or begun before or after the commencement of the Agricultural Holdings Act, 1908.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

FIELD CROPS.

Varieties of Wheat (*East Anglian Inst. of Agric., Chelmsford, Rept. on Field Expts.*, 1912).—(*a*) *Winter Wheats.*—Half-acre plots of seven varieties were grown on two farms. The varieties tried were Little Joss, Browick, Sensation, Wilhelmina, Garton's Victor, Carter's White Stand-up, and Squarehead's Master. The first four varieties were tried also at two other centres. The average yields in bushels per acre of the four varieties grown at all four stations were:—Little Joss, 42·4; Wilhelmina, 42·2; Browick, 39·5; and Sensation, 36·3. The average yields of the three varieties which were only tried at two centres were (bushels per acre):—Victor, 49·4; White Stand-up, 46·2; and Squarehead's Master, 43·0.

(*b*) *Spring Wheats.*—In continuation of the 1911 trials, the varieties Red Marvel, Dreadnought, Burgoyne's Fife, Svalöf Pearl, and Squarehead's Master, were tested at two centres. At the first the seed was sown on March 27th, and at the second on March 28th, at the rate of three bushels per acre. At the first centre the wheats followed maize (dunged), which followed lucerne. At the second centre they succeeded roots, which succeeded grass carrying poultry. The average yields per acre in 1912 were:—Red Marvel, 38·6 bush.; Svalöf Pearl, 31·5 bush.; Burgoyne's Fife, 31·2 bush.; Dreadnought, 30·4 bush.; and Squarehead's Master, 11·0 bush. In 1911, however, Red Marvel (53 bush. per acre) was inferior to Dreadnought (58 bush. per acre), owing probably to the difference in the weather of the two seasons. Dreadnought has a longer period of growth than Red Marvel, and was distinctly later in coming into ear; it should not therefore be sown late. Svalöf Pearl seems to be a wheat of fair cropping capacity, but was distinctly inferior in quality to Svalöf Kolben, tried by the Institute in 1911. In 1911 Burgoyne's Fife was equal in yield to Red Marvel and Squarehead's Master, and much superior in quality. In 1912 it proved a fair but uncertain cropper. Squarehead's Master was again tried as a spring wheat, but, having been sown too late, it proved a failure. Sown the previous year on February 23rd, it cropped well. If, therefore, this variety is used as a spring wheat, it must be sown early.

---

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

(*c*) *Time of Sowing.*—Red Marvel was sown at one station in two lots on March 27th and April 12th, respectively. The March-sown wheat gave 35·8 bush. per acre, and the April-sown 29·6 bush.

Experiments with Potatoes (*East Anglian Inst. of Agric., Chelmsford, Rept. on Field Expts.*, 1912).—*Varieties.*—The "seed" in the variety test was obtained from Scotland. The tubers were planted on April 19th in drills 28 in. apart. They received the following dressing of artificials per acre:—1 cwt. sulphate of ammonia, 4 cwt. superphosphate, 1 cwt. sulphate of potash, and ½ cwt. steamed bone flour. Of the earlies, Eclipse took first place, both in 1912 and 1911, and, it is stated, may be recommended with some confidence as a heavy yielding early potato of good quality. The yield of Epicure was practically equal to that of Eclipse, but, on account of its coarseness and deep eyes, it is not so good a tuber. Sharpe's Victor yielded well; Duke of York and Sharpe's Express were below the other three earlies in yield. The second earlies tried were British Queen and Macpherson; the former was the better cropper. Of the late varieties, Up-to-Date was best, followed by Northern Star.

Change of Seed.—The value of the change of seed was brought out in a striking manner, the crops obtained from Irish and Scotch seed being almost double those from seed grown locally. Seed from Lincolnshire, although not so good as Irish and Scotch seed, was distinctly superior to that from Essex. Seed from Scotland which had been grown one year locally was found to be markedly inferior to seed obtained directly from Scotland in the case of each of six varieties which were so tested.

Size of Seed.—Large seed consisting of the smaller tubers from the "ware" of the variety King Edward VII. gave a better crop than small seed of the ordinary seed size.

Varieties of Barley (*East Anglian Inst. of Agric., Chelmsford, Rept. on Field Expts.*, 1912).—Tests with Archer, Plumage, Chevalier, Maltster (Garton's), and Beaven's No. 145, were carried out at four centres. Seeding was at the rate of 3 bush. per acre at three centres, and 2½ bush. at the fourth centre. The average yields per acre at the four centres were:—Archer, 49·1 bush.; Beaven's No. 145, 46·3 bush.; Plumage, 43·5 bush.; Chevalier, 43·3 bush.; and Maltster, 41·7 bush. Archer proved on the whole the best cropper in 1911 also, so that it seems fairly well established that on various soils in Essex and Herts Archer is a variety which can be relied upon to give a good crop. The seed used was a pure line Archer, selected and tested by Mr. Beaven. Although at two out of three stations in 1911 Plumage proved the best yielder of the varieties tried, in 1912 its yield was lower than that of Archer at all but one centre. At one centre Plumage was distinctly the best barley for quality. Beaven's No. 145 is a cross between Archer and Plumage. It has a short neck like Archer, but is superior in quality to the latter. Maltster proved of moderate quality only, and its yield was not good. Its chief feature was the stiffness of its straw. As regards standing quality, Maltster and Beaven's No. 145 were best, Plumage was intermediate, while Archer and Chevalier went down rather badly.

Varieties of Barley (*East Suffolk County Educ. Com., Rept. for season* 1912).—Seven varieties of barley were tried on three farms, but on only one farm were the results considered reliable. The yields were (bush. per acre):—Pure Archer (Beaven's strain), 46; pure Archer (Irish strain), 43; Page's Chevalier (Suffolk), 35; Chevalier (Norfolk), 33; Goldthorpe (Irish strain), 30; Primus (Sweden), 29; Burton Malting (Wordsley), 29. It is pointed out that experiments in Great Britain, Ireland, and Denmark have shown the general superiority on most soils of Archer barleys over other kinds in cropping capacity.

Varieties of Oats (*East Anglian Inst. of Agric., Chelmsford, Rept. on Field Expts.*, 1912).—The dates of sowing ranged from March 16th to April 10th. The test was carried out at four centres, the seeding being at the rate of 4 bush. per acre. The average yields in bush. per acre of the five varieties tried were as follows:—Golden Rain, 52; Abundance, 47; Victory, 47; Beseler, 46; and Yielder, 43. The yields were low on the whole, and it is pointed out that, as an indication of cropping capacity, too much importance should not be attached to these figures, as the plots were attacked by the Frit Fly. Golden Rain is a Svalöf oat of a golden colour; it has the reputation of being a very heavy yielder, and has a stiff straw.

Varieties of Oats (*East Suffolk County Educ. Com., Rept. for season* 1912).—This experiment was conducted at one centre only. The object was to compare older varieties, such as Giant Eliza and Abundance, with the more recent introductions. The yields were poor, owing to damage by Frit Fly. The returns in bush. per acre were:—Thousand Dollar, 63½; Scottish Chieftain, 62¾; Abundance, 61; Record, 61; Ligowo (Swedish), 61; Giant Eliza, 55½; Triumph, 50; Rival, 49; Propsteier (Swedish), 47.

The yields of Record, Triumph, Rival, and Propsteier are estimates only, these varieties having been damaged by rain before threshing.

DAIRYING.

Milk Records (*Scottish Milk Records Committee: Rept. on Milk Records for Season,* 1911. *Standard Press, Kilmarnock*).—These records relate to 13,965 cows. The lactations recorded are those actually or practically terminating in 1911. The report records that "experience confirms the view that the best unit to employ in the comparison of milk yields of various qualities is that which reckons them in terms of gallons estimated at 1 per cent. of butter fat." Yields of which the quantity and quality taken together amount, in the case of cows, to 2,500 gallons calculated on a basis of 1 per cent. fat, and, in the case of heifers, to 2,000 gallons, are considered good. Cows and heifers giving below 1,660 and 1,330 gallons respectively are classed as bad. The "good" figures correspond to 714 and 570 gallons on a quality basis of 3·5 per cent. fat, while the "bad" figures correspond to 474 and 380 gallons respectively. The statements of milk yields are given in terms of actual quantity and quality of milk, and not in terms of the hypothetical unit mentioned above. A lengthy appendix gives the results on individual farms, showing in each case (*a*) Cows yielding over 2,500 gallons, calculated at 1 per cent. butter fat; (*b*) Heifers

yielding over 2,000 gallons, calculated at 1 per cent. butter fat; (*c*) Cows yielding under 1,660 gallons, calculated at 1 per cent. butter fat; (*d*) Heifers yielding under 1,330 gallons, calculated at 1 per cent. butter fat.

The work was administered through local Milk Record Societies, of which a list is given. Five new societies were formed during 1911, and the number of herds under test rose from 217 in 1910 to 333 in 1911, while the total number of cows tested shows an increase from 9,500 in 1910 to 13,965 in 1911. Taking only those societies which were in existence in both years, out of 9,514 animals tested in 1910, 1,756 cows and 627 heifers were "good," and 495 cows and 60 heifers were "bad," while out of 10,044 animals tested in 1911, 2,071 cows and 805 heifers were "good" and 443 cows and 27 heifers were "bad."

The Bacteriology of Cheddar Cheese (*U.S. Dept. of Agric., Bureau of Animal Industry, Bull.* 150).—It is pointed out that various factors which determine the character of the finished cheese are to be found in the methods of the cheesemaker, who is able to vary in one way or another the composition of the cheese, with the result that conditions are established that favour or retard the growth of the groups of micro-organisms, which must be the determining factors between different kinds of cheese. The only group of bacteria found constantly in great numbers in Cheddar cheese by previous investigators is the *Bacterium lactis acidi,* but the present work shows that the above group is followed in comparable numbers by another, namely, the *Bacillus Bulgaricus* group. The members of the latter attain their maximum numbers within the first month of ripening. Since they develop after the fermentation of the sugar they must have some other source of carbon and of energy. The view is expressed that coccus forms also are constantly found in large numbers in Cheddar cheese. A point of much interest which the present report advances is the fact that *B. lactis acidi* is able to form acid in the absence of the living cell. The functions of the *B. lactis acidi* group in Cheddar cheese are summarised thus:—(*a*) They favour the curdling of milk by rennet; (*b*) through the acid they influence the shrinking of the curd and expulsion of the whey; (*c*) the acid they produce causes "matting"; (*d*) the acid activates the pepsin of the rennet extract; (*e*) the acid prevents the growth of putrefactive bacteria.

POULTRY.

Utility Poultry Club's Twelve Months' Laying Competition (*Summary of Results for the Fourth Period, ended February 4th,* 1913).—During the fourth period of four weeks the 600 pullets entered in the above competition have laid 6,760 eggs. The results, as compared with last month's figures, show very little change in the position of the six leading pens. Pen No. 86 (Buff Rocks) still retains the lead with a total of 362 eggs, amounting in value to £2 12*s.* 8½*d.*, and is closely followed by Pen No. 60 (White Wyandottes), of which the total amounts to 350 eggs, of the value of £2 7*s.* 4*d.*

The highest score for the month stands to the credit of Pen 29 (White Wyandottes), which produced 121 eggs, valued at 12*s.* 3½*d.* The birds in this pen have laid well throughout the month, but have lost points through the inferior size of the eggs.

The White Wyandottes in Pens No. 32 and 45 retain the same

positions as they held last month, viz., third and fourth respectively, but Pen 24 (Black Leghorns) has changed places with Pen 80 (Buff Orpingtons).

The best *individual* record has been made by Buff Orpington No. 452, with a total of 25 eggs in 28 days; of these eighteen ranked as first grade, and seven as second grade. Good records have also been made by Buff Orpington No. 451 in the same pen as No. 452, by the White Wyandotte No. 276 and the Buff Rock No. 537, which have each laid 24 eggs during the four weeks.

During the period under review the weather has been the wettest experienced since the commencement of the competition, the temperature has been low, and there has been a certain amount of fog. These conditions have proved unfavourable, and have made it difficult to keep the birds dry.

The light breeds have been affected by the weather to a far greater extent than the heavy breeds, and have taken a much longer time to resume laying.

The health of the competing pens throughout the period has been good, and no deaths have occurred.

Poultry Experiments (*Ohio Agric. Expt. Sta., Circular No.* 118).—This circular relates to a co-operative investigation on the profitableness of poultry when kept under farm conditions.

The investigations concerned flocks kept in the city and penned throughout the year, flocks located in suburbs with limited range, and flocks on the farm with unlimited range. The co-operators were located in thirty-six counties of the State, and represented widely varying phases of the poultry industry.

In conducting the experiment, each flock was inventoried at the beginning and again at the end of the year, and each co-operator was furnished with a pad of twenty-four blank forms so that a duplicate record for each month might be kept; one of these records was sent to the station and one was retained by the owner of the flock. The forms provided for a statement of summaries, so that the totals from the monthly records might be carried forward, and one copy of the summary was sent to the station at the end of the year in order to check the monthly return sheets of the flock. Average results per annum were as follows:—

AVERAGE RESULTS FROM EIGHTEEN FLOCKS KEPT ON FARMS.

	No. of Fowls.	Eggs per Hen.	Value of Equipment.	Labour Cost per Fowl.	Feed Cost per Fowl.	Value Eggs Sold	Value Poultry Sold.	Total Cash Receipts.
			£ s. d.	s. d.	s. d.	£ s.	£ s. d.	£ s.
Average	121	71	13 13 4	1 2	2 6	25 4	9 10 3	34 15

	Eggs Used.		Poultry Used.		Profit per Fowl.
	No.	Value.	No.	Value.	
		£ s. d.		£ s. a.	s. d.
Average	1,056	3 16 8	28	2 17 4	3 7

AVERAGE RESULTS FROM TWELVE TOWN FLOCKS KEPT WHOLLY OR PARTIALLY CONFINED.

	No. of Fowls.	Eggs per Hen.	Value of Equipment.	Labour Cost per Fowl.	Feed Cost per Fowl.	Value Eggs Sold.	Value Poultry Sold.	Total Cash Receipts.
			£ s. d.	s. d.		£ s. d	£ s.	£ s. d.
Average	46	70	18 8 10	2 6	4s.	5 12 4	6 2	14 14 3

	Eggs Used.		Poultry Used.		Profit per Fowl.
	No.	Value.	No.	Value.	
		£ s. d.		£ s. d.	s. d.
Average	916	3 9 10	21	2 1 5	1 6

The result of the investigation showed that:—

1. Both in town and country small flocks gave greater profits than large flocks.
2. Flocks with unlimited range produced better profits than flocks partly or wholly confined.
3. Farm flocks were more profitable than village or city flocks.

WEEDS AND PLANT PESTS.

Eradication of Wild Radish in Serradella (*Biedermann's Zentralblatt für Agrikulturchemie, December,* 1912).—It is suggested that, while wild radish can be eradicated from cereals by spraying with sulphate of iron, this procedure cannot be adopted in the case of leguminous plants on account of the damage done to the cultivated plants. The present experiments sought to ascertain the effect of sulphate of iron on serradella, and it was found that plots sprayed twice with 10 per cent., 15 per cent., 20 per cent., and 25 per cent. solutions, with an interval of three days between the two sprayings, suffered very badly in all cases, even after the first spraying only. In experiments in the field, serradella, grown both alone and amongst rye, was sprayed with sulphate of iron at the time of the appearance of the fourth or fifth leaf on the wild radish plants. In all stages of growth the serradella showed itself to be extremely susceptible to injury from the sulphate of iron, and it is stated that the use of this solution can only be recommended in exceptional cases. Cutting the wild radish would appear to be the most efficacious means of protecting the serradella crop.

Some Factors Influencing the Efficiency of Bordeaux Mixture (*U.S. Dept. of Agric., Bureau of Plant Industry, Bull.* 265).—This investigation was undertaken to discover by what methods the most uniform distribution of the copper compound in the Bordeaux mixture can be obtained, and to ascertain how the adhesiveness of the mixture to the susceptible parts of the plants can be increased.

The following conclusions were arrived at:—

(1) That a Bordeaux mixture in which the suspension of the copper compound settles out slowly may be prepared by adding the concentrated calcium hydroxide to the diluted copper suphate solution or *vice*

versâ, provided the mixture is sufficiently agitated. Practically as good results were obtained with these methods of preparation as by diluting the two components in separate vessels and pouring them simultaneously into a third.

(2) That the addition of certain substances tended to increase the adhesiveness. From experiments with grape berries it was concluded that the addition of an adhesive to the fungicide was necessary in order to cause the latter to adhere to the bloom-covered grapes. Rosin-fish-oil soap gave the best results as an adhesive, ground glue came second, and fish-oil soap third. Ferrous sulphate did not increase the adhesiveness of the mixture to the berries. No appreciable quantity of copper was found on the berries sprayed with Bordeaux mixture alone.

In the case of leaves it was shown that rosin-fish-oil soap added slightly to the adhesiveness of the mixture. The strength of rosin-fish-oil recommended is 2 lb. to 50 gallons of Bordeaux mixture.

NOTES ON AGRICULTURAL CO-OPERATION.

Prees Cottagers' Cow Club.

A full account of the working of this very successful Cow Insurance Society was given in the *Journal* for August, 1912. Briefly, it consists of 179 members, mostly small-holders, and insures 537 cows and calves against death from disease or accident. The average death-rate for the last ten years is only 2·1 per cent. per annum, which compares favourably with the average rate (2·4 per cent.) for the 22 registered cow insurance societies in England and Wales. The members pay an insurance contribution of 1*s.* per quarter for each cow, and 9*d.* per quarter for each calf, which has been found more than sufficient to cover the losses, so that the balance to the credit of the insurance fund has increased in the ten years from £724 to £1,040. Until three years ago the maximum amount payable on an insured cow was £10; but the society, finding that its income exceeded its expenditure, then raised the maximum payable per cow from £10 to £12. It has now, after taking into consideration the statement of its financial position given in the article referred to, resolved to make the following further concessions to its members:—

(1) It has increased the maximum amount payable per calf by £1, making it £6 for a calf over six months old, and £3 for a calf between three and six months old.

(2) It has relieved the members from the payment of 2*d.* per head per annum for management expenses, which will now be defrayed from the interest on the reserve fund and other miscellaneous income.

(3) It has reduced the insurance contribution for cows payable by all members of not less than ten years' standing by 3*d.* per quarter, to 9*d.* per cow.

It has also resolved to increase the salary of the secretary, and make it £1 per annum for every hundred animals insured, and to pay the steward out of the funds for visiting any animal which he finds too unsound to mark, or for visiting a sick animal which recovers.

The chief result of these concessions is that all members of the club of over ten years' standing will have their cows insured up to a maximum of £12 on a total payment of the very low rate of 3*s.* per cow per annum.

Welland High Bridge Pig Club—Spalding.

This is an unregistered Pig Club at Spalding, in Lincolnshire, which has been in existence since 1897, and now consists of 48 members, mostly working-men, about half of them being employed on the railway. Only persons resident within two miles of the headquarters of the club are accepted as members.

During the last nine years the number of pigs insured has increased from 36 to 68, mostly store pigs, kept and fattened by members for their own consumption. For the nine years taken together, the total number of pigs insured was 485, and the total number of deaths was 28, which gives an average death-rate of 5·8 per cent per annum. This is considerably higher than the average death-rate (3·8 per cent.) for the 31 registered village pig clubs in England and Wales.

This club pays its members seven-eighths of the value of any pig that may die in consequence of disease or accident, and during the nine years it paid on the 28 pigs that died £65 14*s.*, which gives an average of £2 7*s.* per pig that died, and an average of 2*s.* 9*d.* per pig insured.

The management expenses amounted to £8 3*s.*, which gives an average of 4*d.* per annum per pig insured, so that the total expenditure proper of the club for insurance purposes was only £73 17*s.*, or almost exactly 3*s.* per pig insured. But in addition to this expenditure the club defrayed the cost of an annual supper amounting for the nine years to £30 1*s.*, equivalent to 1*s.* 3*d.* per pig insured, and thus the total expenditure of the club amounted to £103 18*s.*

The income consisted almost entirely of premiums, amounting in all during the nine years to £108 16*s.*, or an average of 4*s.* 6*d.* per pig insured, the insurance contribution being charged at the rate of 1*d.* per week, that is, 4*s.* 4*d.* per annum for every store pig, with 1*s.* extra for a breeding sow. Besides this, there was an income of over £2 14*s.* from interest received, so that, even after defraying the cost of the annual supper, the income of the club exceeded its expenditure by £7, and the reserve fund, which represents the savings of past years, rose during that period from £24 to £31. This is equivalent to nearly 10*s.* per pig on the number of pigs now insured, and as the average expenditure on claims is 2*s.* 9*d.* per pig insured, this reserve fund is now in itself sufficient to pay the losses of nearly four average years. Thus the club is now in a fairly sound financial position.

The table on p. 1037 gives a statement of the financial position of the club for the past nine years.

Agricultural Credit Banks in France in 1911.*

The State funds in France which are available for loan to agriculturists are lent by the Bank of France, free of interest, in return for certain privileges, and consist of a fixed sum of £1,600,000, together with a sum which varies yearly, but which in 1911 amounted to £288,000. The State utilises this amount by

---

* *Rapport sur le Fonctionnement des Caisses de Credit Agricole Mutuel en* 1911 (*Journal Officiel*, 19 Sept., 1912), and *Mitteilungen der Fachberichterstatter Austria*). No. 21, 1912. See also the *Journal*, Jan., 1911, p. 844.

WELLAND HIGH BRIDGE PIG CLUB.

Year.	No. of Members at the end of the Year.	No. of pigs insured at the end of the Year.	No. on which claims were paid during the Year	Death-rate per cent.	Insurance Fund.							
					Expenditure.				Income.			Amount of Insurance Fund at end of Year.
					Amount paid on Claims.	Cost of Supper.	Management Expenses.	Total Expenditure of Insurance Fund.	Income from Premiums and Entrance Fees.	Interest.	Total Income of Insurance Fund.	
					£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
1904	37	36	3	8·3	3 3	2 15	17	6 15	8 7	8	8 15	25 14
1905	33	41	2	4·9	4 1	2 3	16	7 0	8 10	8	8 18	27 12
1906	28	40	2	5·0	3 8	3 10	14	7 12	8 6	8	8 14	28 13
1907	33	54	3	5·5	14 6	2 18	14	17 18	10 10	6	10 16	21 11
1908	40	64	2	3·1	5 18	3 3	17	9 18	14 5	4	14 9	26 2
1909	48	67	3	4·5	6 3	4 4	1 3	11 10	15 0	5	15 5	29 17
1910	40	49	2	4·0	6 16	3 8	18	11 2	13 19	4	14 2	32 18
1911	50	66	5	7·6	11 0	3 4	18	15 2	14 4	5	14 10	32 6
1912	48	68	6	8·8	10 19	4 16	1 6	17 1	15 15	6	16 1	31 6
Total		485	28	5·8	65 14	30 1	8 3	103 18	108 16	2 14	111 10	

granting loans to the district credit banks; these banks, however, do not come into contact with the actual borrowers, but operate through the local credit banks. The district banks are, in fact, the bankers of the local banks, and a considerable proportion of their capital is held by the local banks. It is to the interest of the local banks to increase the capital of the district banks, since the loans of the State increase with the paid-up capital of the district banks.

The chief business of the banks is in discounting bills. The member of a local bank to whom a loan for a short period is to be granted draws a bill of exchange on himself, which is discounted by the local bank at the district bank, and, as a rule, by the district bank with the Bank of France, the three endorsers affording ample security to the last-named. The rate of discount charged by the district banks must be that charged by the Bank of France. In addition to discounting bills several district banks make loans to local banks for their working capital, with which the latter banks can operate directly. Supervision is exercised by the State with a view to ensuring that the profit made by the district banks in discounting is utilised to cover the costs of management and to build up a reserve fund, and not for the purpose of lowering the rate of discount. The granting of loans for short periods is governed by laws of 1894, 1899, 1906, and 1910.

There were 97 district credit banks in existence in France in 1911; these, together with two fixed credit banks (*caisses de crédit immobilier*), received advances amounting to £703,000 during the year; and the total amount on loan to these banks from the State on December 31st, 1911, was £2,939,000. Of the former amount, £419,000 was lent to the district banks for their loans for short periods. The subscribed capital of the district banks at the end of 1911 amounted to £841,000, of which £777,000 was paid up; of this latter sum £483,000 was contributed by the local banks. In all, the sum of £3,413,000 was at the disposal of the district banks in 1911 for loans for short periods (viz., paid-up capital £777,000, reserve fund £150,000, total advances from the State £2,391,000, deposits £96,000), as against £2,857,000 in 1910. (It is interesting to note that the total deposits exceeded those of 1910 by about £80,000, and amounted in all to £734,000.)

The transactions of the district banks in 1910 and 1911 were as follows:—

	1910.	1911.
	£	£
Bills discounted and renewed...	5,235,000	6,503,000
Advances to local banks for working capital ...	50,000	58,000
Loans during the year	2,678,000	3,251,000
Loans outstanding at end of previous year... ...	1,639,000	1,980 000
Total	4,367,000	5,289,000
Repayments during the year	2,388,000	2,895,000
Loans outstanding on December 31st	1,979,000	2,394,000

Loans for short periods to agricultural co-operative societies in 1911 were estimated at £560,000. The expenses of management of the district banks were equal to 0·334 per cent. of the total loans. The reserve funds increased from £150,000 to £195,000 during the year.

The development of the local banks during the year was as follows:—

	1910.	1911.
Number of banks	3,338	3,946
,, ,, members	143,751	185,552
Subscribed capital	£568,000	£726,000
Paid-up capital	£397,000	£471,000
Loans on short term made during year	£2,821,000	£3,302,000
Loans outstanding at end of previous year	£1,707,000	£2,079,000
Total	£4,528,000	£5,381,000
Repayments during year	£2,449,000	£2,917,000
Loans outstanding on December 31st	£2,079,000	£2,464,000
Reserve Funds	£62,000	£80,000

Loans for Long Periods.—A law of December 29th, 1906, authorises the granting of loans for long periods to co-operative societies for the production and sale of agricultural produce. The maximum period is twenty-five years, and the loan must not exceed in amount double the paid-up capital of the co-operative society. The rate at which the loan is discounted must not be more than 2 per cent. There are very few newly-formed co-operative societies for the manufacture or sale of agricultural produce which do not borrow under this law. In 1911 78 such societies obtained loans to the amount of £95,000. By the end of 1911 202 societies in all had received loans amounting to £265,000. These societies comprised 61 societies for fruit preserving and the manufacture of cheese, 41 dairies, 32 vinicultural societies, 19 distilling societies, and 26 societies for the purchase and common use of machinery.

A law of March 19th, 1910, provided for the granting of long-period loans to individuals. Loans up to £320 in amount, and up to 15 years in duration, are granted to small agriculturists, for the purchase of holdings or for carrying out improvements on their holdings, through the medium of local banks and district banks. The district banks are liable to the State for these loans. The sum of £282,000 has been placed at the disposal of 72 district banks, and two fixed credit banks in 1910 and 1911 for the purpose of granting loans for long periods under this law. In 1911, 981 new loans were made by the banks, of the value of £146,000. In the two years 1,155 agriculturists have obtained advances amounting to £184,000. These loans are only granted by the district banks where the latter are satisfied that they are instrumental in keeping a family on the land or in creating or consolidating a small holding. A law is in contemplation, however, which will give other agriculturists the benefit of these loans.

OFFICIAL NOTICES AND CIRCULARS.

Foot-and-Mouth Disease. Hay and Straw used for Packing.

The Board of Agriculture and Fisheries desire to call attention to the possible risk of Foot-and-Mouth Disease being introduced into Great Britain by means of hay and straw used for the packing of foreign imported goods.

This question was considered by the Departmental Committee appointed by the President of the Board to inquire into Foot-and-Mouth Disease in Great Britain. In their Report the Committee pointed out that numerous imported articles are packed in hay or straw, and that a large proportion of this packing ultimately reaches the farm as manure. The Committee considered that this packing constitutes a source of danger, but in view of the serious dislocation of general trade which the prohibition of its use would entail, they were not prepared, unless there is further evidence, to advise such a course. The Committee, however, recommended that persons using such hay and straw should be warned of the element of danger which it contains, and of the risk of allowing it to come in contact with any animals; they also advised that where possible it should be burned.

The Board hope that, with a view to minimising the risk referred to, manufacturers and traders, and all who receive hay and straw used for the packing of foreign imported goods, will take the necessary steps to prevent this packing material being sent to farms or other places where it can come into contact with live stock, and will make arrangements for the burning of such material.

Animals (Landing from Ireland) Order of 1913.

As there seems to be an impression that the landing of Irish animals is materially restricted owing to want of accommodation at the various landing places, the following figures are of interest:—

NUMBER LANDED DURING THE FOUR WEEKS ENDING—

	Feb. 22, 1913.	Feb. 24, 1912.
Cattle	96,432	36,049
Sheep	21,870	13,113
Swine	19,524	38,413

The existing Order came into force on January 30th. No doubt the great increase in the number of cattle landed is due to cattle held over during the period in which quarantine restrictions were in operation.

Regulations as to the Growth of Tobacco for Nicotine Extraction.

The following Regulations have been made by the Commissioners of Customs and Excise under Section four of the Finance Act, 1912, in relation to tobacco grown in the United Kingdom:—

The Commissioners of Customs and Excise in pursuance of the powers vested in them by Section four of the Finance Act, 1912, do hereby make the following regulations to be observed on and after the first day of March, 1913, by persons licensed to grow tobacco within the United Kingdom and authorised by the said Commissioners to grow tobacco solely for the purpose of obtaining an extract therefrom to be used without payment of duty for the manufacture of insecticides or sheep-wash or for other purely agricultural or horticultural purposes.

1. A person who desires to obtain the authority of the Commissioners of Customs and Excise to grow tobacco within the United Kingdom solely for the purpose of obtaining an extract therefrom to be used without payment of duty for the manufacture of insecticides

or sheep-wash or for other purely agricultural or horticultural purposes, must furnish on a form of application to be obtained by him from the proper Officer a statement of the variety or varieties of tobacco to be grown and of the process of extraction to be used by him and such further particulars as may by the form be required and must return the form duly filled up and signed by him to the Officer. The application may be made at the same time as the application for a licence to grow tobacco or by a person who has already obtained such a licence, and the authority when granted shall be in force only during the currency of the licence.

2. A person to whom an authority has been granted (hereinafter referred to as an authorised person) must, in connection with this authority, grow only such variety or varieties of tobacco as may be approved by the Commissioners, and all tobacco so grown by him must be used solely for the purpose of an extract being obtained therefrom.

3. No alteration of the process of extraction, as described in the form of application, shall be made without the sanction of the Commissioners.

4. Except as hereinafter provided an authorised person must observe the regulations made under Section three of the Finance Act, 1908, and Section eighty-three of the Finance (1909–10) Act, 1910, in relation to tobacco grown in the United Kingdom.

5. The following regulations in relation to the obtaining of an extract shall be substituted for those regulations so far as they relate to the curing of tobacco:—

(i) The entry to be made by an authorised person (in the "Tobacco Entry Book" supplied to every grower and curer of tobacco) shall include any shed or place to be used by him for preparing or storing tobacco extract or tobacco refuse, and the security to be given by him shall extend to the observance of all regulations made by the Commissioners in relation to the tobacco extract obtained from any process of extraction and the tobacco refuse resulting therefrom, and to the removal of any tobacco to the premises of another authorised person, or of any tobacco or undenatured tobacco extract to the bonded premises of a tobacco extract or nicotine manufacturer.

(ii) An authorised person who intends to obtain an extract from tobacco must provide to the satisfaction of the Commissioners a room or building and a store suitable for carrying on the process to be used by him in obtaining and storing the extract, and must produce for inspection by the proper Officer on his visit to the premises all tobacco extract obtained and all tobacco refuse resulting from the process since his last visit, and such extract and refuse must be kept separate and untouched until they are inspected by the Officer. The authorised person must destroy the refuse at such time or times and in such manner as the Commissioners shall direct.

(iii) All tobacco extract prepared by an authorised person shall be denatured to the satisfaction of the Commissioners in the presence of the proper Officer before being used or delivered for use, provided that an authorised person may, with the permission of the Commissioners, remove tobacco grown by him to the premises of another authorised person, and may, with the like permission, remove such tobacco and undenatured tobacco extract to the bonded premises of a tobacco extract or nicotine manufacturer.

(iv) The notice in writing required to be given before commencing to cut or gather any tobacco shall state whether it is intended to dry the tobacco when cut or gathered or to use it in the green state in obtaining tobacco extract, and an authorised person shall, 48 hours at least before commencing to prepare any extract, give to the proper Officer notice in writing of his intention to do so, and shall state in the notice the date when the extract will be ready for being denatured.

(v) An authorised person must make in the entry book required to be kept by him in addition to the entries required to be made by him as a grower of tobacco, the following entries:—

(*a*) He shall, at least 48 hours before subjecting tobacco to any process for obtaining an extract therefrom, enter the date and hour when the process is to commence, and the weight of the tobacco, or, in the case of tobacco in a green state, the estimated weight of the tobacco to be used in the process.

(*b*) He shall, at the close of each process for obtaining an extract from tobacco enter the number of gallons of extract obtained, and also, if so required by the Commissioners, the specific gravity of the extract.

(*c*) He shall, at least 48 hours before the removal of any tobacco extract to the approved premises of a tobacco extract or nicotine manufacturer, enter the date of the intended removal and the situation of the premises to which the tobacco extract is to be removed; and, on the removal of the tobacco extract, shall enter the actual date of removal and the actual quantity by measure of the tobacco extract removed.

(vi) All undenatured tobacco extract which, with the permission of the Commissioners, an authorised person removes to the bonded premises of a tobacco extract or nicotine manufacturer, shall, prior to removal, be measured in the presence of the proper Officer, and every authorised person shall, 24 hours at least before beginning to remove or measure any undenatured tobacco extract, give to the proper Officer notice in writing of his intention to do so, and all undenatured tobacco extract so removed shall be accompanied by a permit granted by the proper Officer.

(vii) A manufacturer of tobacco extract or nicotine shall deliver all permits and certificates accompanying tobacco or tobacco extract received by him from an authorised person to the Officer who first visits his premises after the receipt of the tobacco or tobacco extract.

(viii) An authorised person shall render all necessary assistance to the Officers in taking account of tobacco and tobacco extract in his possession, and in taking samples thereof and of all substances used by him for the purpose of obtaining or denaturing the extract, and shall provide suitable measures capable of measuring the tobacco extract. He shall, if so required by the Commissioners, provide to their satisfaction a room or building capable of being secured with a revenue lock in which to store tobacco extract when produced.

(ix) All tobacco grown by an authorised person in one year, which has not before the last day of February in the following year been used in obtaining an extract therefrom in conformity with these regulations, shall be disposed of in such manner as the Commissioners may direct.

Circular Letter as to Tuberculosis.

The Board have addressed the following circular letter, dated February 17th, 1913, to Local Authorities in Great Britain under the Diseases of Animals Acts, 1894 to 1911:—

SIR,

1. I am directed by the Board of Agriculture and Fisheries to send to you for submission to your Local Authority, the enclosed copies of the Tuberculosis Order of 1913, which will come into operation on the 1st of May, 1913.

2. This Order follows generally the Order of 1909, which, as your Local Authority are aware, was withdrawn before it came into operation, but in connection with the cost of administering the Order, I am to inform you that the Board have obtained from the Lords Commissioners of His Majesty's Treasury authority to refund to Local Authorities from moneys provided by Parliament one-half of the net amount payable by way of compensation for slaughtered animals during a period of five years from the coming into operation of the Order. Local Authorities will thus receive substantial pecuniary relief during the initial stages of the operations now to be undertaken, during which the expenditure involved in the administration of the Order may be expected to be abnormally high.

3. As was pointed out in the Circular Letter to Local Authorities issued with the Order of 1909, the subject of tuberculosis in man and in animals, and the relations between the disease in human beings and in animals has been the subject of careful investigation both in this country and abroad during recent years, and various phases of the question have been inquired into by successive Royal Commissions. As regards the possibility of the transmission of the disease from affected bovine animals to man, the Board are satisfied that it must be accepted as a fact that tuberculosis is transmissible by the agency of milk used for human consumption.

4. In considering the question of tuberculosis in relation to animals, the fact that the disease is thus communicable to man has a material bearing on the measures to be adopted. Any action which results in the reduction in the number of tuberculous bovine animals in the country must reduce the risk of the spread of tuberculosis amongst the community, and if it were possible to eradicate from this country the disease in animals, a material step forward would have been taken in the campaign against the disease in man.

5. It is abundantly clear, at the same time, that any operations aiming at the diminution or eradication of tuberculosis in animals must be commenced with caution, and carried out with due regard to the extent to which the disease is believed to exist amongst cows, and to the importance of securing the continuance of an adequate milk supply, and also of avoiding any disorganisation of the important industry concerned.

6. The Order, the leading provisions of which are set out below, aims at securing the destruction of every cow found to be suffering from tuberculosis of the udder, or to be giving tuberculous milk, as well as of all bovine animals which are suffering from tuberculosis with emaciation, since these are known to disseminate freely the germs of the disease. In thus confining the provisions of the Order to those forms of tuberculosis only, the Board have not lost sight of the fact

that it may be possible in the future to take further action in the light of the experience gained. They feel, however, that heroic measures taken at the present time would only defeat their own object.

7. Local Authorities for the purposes of the Diseases of Animals Acts are charged with the duty of investigating reports received under the Order, with the assistance of a Veterinary Inspector, with a view to causing the slaughter of any animal in their District shown to be suffering from one of these specified forms of tuberculosis. Under Article 4 of the Order the Veterinary Inspector will be able to extend his examination to any bovine animals upon the premises that have been associated with a suspected animal, in order that he may at the same time take steps to deal with any other bovine animal which in his opinion presents clinical symptoms of tuberculosis; and for the purpose of assisting him in his diagnosis he may, but only with the written consent of the owner of the animal, apply the tuberculin test to any animal which the Inspector suspects of suffering from one of the specified forms of tuberculosis. Power is also given to the Veterinary Inspector to take samples of milk and of fæces, urine, and abnormal discharges, the intention being that he shall make use of bacteriological methods for the purpose of diagnosis.

8. The Local Authority are required by Article 5 of the Order to cause every animal found by them to be suffering from one of the specified forms of tuberculosis to be slaughtered. The animal to be slaughtered is to be valued in its condition at the time of valuation. Inasmuch, however, as the clinical diagnosis made by the Veterinary Inspector prior to slaughter may not be confirmed on post-mortem examination, it is provided in paragraph (3) of Article 6 of the Order that there shall be separate valuations on the basis both of the animal proving to be affected with tuberculosis and of its proving to be not so affected, and the amount of the compensation will depend on the result of the examination.

9. The compensation payable by the Local Authority for an animal slaughtered under their direction in cases in which the post-mortem examination does not show tuberculosis is a sum equal to the full value of the animal and a further sum of twenty shillings.

10. Where tuberculosis is found the proportion of the value of the animal payable by way of compensation to the owner is made to depend upon the extent of the disease which is present. The Royal Commission of 1898 made certain recommendations with regard to the meat of tuberculous animals (*see* pages 20–22 of their Report), and the Local Government Boards for England and for Scotland adopted those recommendations and issued Circular Letters in the year 1899 for the guidance of Meat Inspectors as to the degree of tubercular disease which, in their opinion, should cause a carcase of an animal, or part thereof, to be seized under the Public Health Acts. The Board have adopted this classification as a basis on which the proportion of compensation payable under their Order is to be determined.

11. The degrees of tuberculosis described in Article 8 (4) of the Order are those which in the opinion of the Commissioners justify the seizure by Meat Inspectors of the entire carcase and all the organs thereof. Wherever such conditions are certified to exist the compensation is fixed at a sum equal to one-fourth of the value of the animal

valued as a tuberculous animal or the sum of thirty shillings, whichever sum is greater, after deducting from such sum one-half of the costs incurred by the Local Authority for any valuation of the animal by a valuer appointed by the Board or for any examination of its carcase by a veterinary surgeon other than the Veterinary Inspector. For convenience these conditions are described in the Order as "advanced tuberculosis." In all other cases of tuberculosis, *i.e.*, in cases where a carcase, if otherwise healthy, need not in the opinion of the Commissioners be condemned under the Public Health Acts except as regards the portions containing tuberculous lesions, the compensation is to be a sum equal to three-fourths of the value of the animal, after deducting from such sum one-half of the costs of valuation and examination as in the preceding case.

12. The Order prescribes the precautions to be taken in respect of the milk, &c , of suspected animals (Article 9), and their detention and isolation whilst under suspicion (Article 10). Provision is also made in Article 11 of the Order for dealing with suspicious animals exposed at Markets, Fairs, or Sales.

13. The Board believe that public opinion is favourable to the adoption of concerted measures designed to check the spread of tuberculosis throughout the country, and no such action can be satisfactory which fails to make provision for dealing with the disease in the animal, but it should, the Board feel, carry with it a full measure of public sympathy and support. The payment to agriculturists of reasonable compensation for animals slaughtered in the public interest must, in the opinion of the Board, be an essential feature of any well-devised scheme for gradually reducing the prevalence of tuberculosis in animals. On the other hand, the liability of the Treasury and of the Local Authority to provide such compensation on the present basis from public funds is a serious one, and cannot be continued unless events show that a return commensurate with the burden imposed is being obtained. It behoves agriculturists, therefore, to second the efforts of the public authorities by the segregation of all bovine animals which respond to the tuberculin test, so as to prevent tuberculosis from being spread within the herd, and the Board will be prepared to advise how this can best be done in particular cases.

14. The Board desire at the same time to point out to Public Health Authorities that any extension in particular localities of the measures now to be taken throughout the country generally, may prejudice their general utility. The danger to the public health from the milk of a cow presenting no clinical symptoms of tuberculosis and not giving tuberculous milk, even should it re-act to the tuberculin test, is admittedly small, and stockowners cannot be expected to pursue the course suggested above unless they are satisfied that re-action to the tuberculin test will not expose their herd to administrative action on the part of Public Health Authorities. It is earnestly to be hoped, therefore, that Public Health Authorities and their officers will as far as practicable conform their procedure. to the lines laid down in the Board's Order.

15. Although it is inevitable that at the outset of the operations the expenditure should be comparatively heavy, inasmuch as the first effects of the Order will be to bring within its purview the cows of

all ages suffering from tuberculosis of the udder or giving tuberculous milk and bovine animals of all kinds which show signs of tuberculosis with emaciation, it is anticipated that when the Order has been in operation for a few years those animals only will fall to be dealt with which from an outwardly healthy condition develop these forms of the disease. The cost to the Local Authority of the administration of the Order after the initial period has elapsed should not be great, and may properly be defrayed in full by Local Authorities in the manner provided for in the Diseases of Animals Acts.

16. The Board have thought it desirable to deal in this letter with the broader aspects of the question only. Points of administrative detail, including the procedure to be followed in connection with the re-imbursement to Local Authorities of sums paid by them in compensation, will be dealt with in a further letter to be sent out nearer the time when the Order actually takes effect. That letter will also deal with the publication of the Order, which need not, in the interval, be proceeded with.

17. In the meantime the Board will be glad if your Local Authority will give immediate consideration to the steps to be taken to put their officers in a position to carry the Order into effect, more especially with regard to the provision of a sufficient and competent veterinary staff.

I am, &c.,
SYDNEY OLIVIER,
Secretary.

Special Research Grants.

The attention of scientific workers is called to the grants that the Board of Agriculture and Fisheries are prepared to make in aid of investigations bearing on agriculture. These grants are made out of a sum of money placed at the disposal of the Board by the Development Commissioners, and it is intended that they should be used for the purpose of carrying on special investigations that have not otherwise been provided for by the Board's Scheme of Research Institutions. These grants can only be made in respect of some definite subject of research connected with agriculture and its allied industries and carried on at a University, University College, or other approved institution. In the event of an application being made by an individual, it must be supported by a recommendation from the authorities of the institution where it is proposed to carry on the research. All applications must be made on a form that may be obtained from the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, S.W. Applications should if possible be forwarded to the Board not later than April 1st, 1913.

Damage to Oats by Frit Fly.

The Board of Agriculture and Fisheries desire to remind all farmers whose oats were injured last year by the attacks of the Frit Fly that in order to reduce the risk of further damage by this pest, the oat crop should be sown as early in the season as possible, and, unless the land is in high condition, a dressing of 1 cwt.

nitrate of soda or ¾ cwt. sulphate of ammonia per acre should be given when the young crop is 4 in. to 5 in. high.

A leaflet on the subject of this fly, and also on the subject of the eelworm which causes tulip root in oats, can be obtained on application to the Secretary of the Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W.

Acreage and Live Stock Returns of 1912.

Part I. of the Agricultural Statistics of 1912 relating to the acreage and live stock returns of England and Wales, in 1912, with summaries for the United Kingdom, has been recently issued by the Board (Cd. 6597, price 5½*d.*, Wyman and Sons). The tables are prefaced by a report by Mr. R. H. Rew discussing the changes in the acreage under the various crops and in the numbers of the different kinds of live stock in 1912 as compared with previous years.

Hop Growing on the Pacific Coast of America.

The Board have issued as a separate publication (Miscellaneous Publications, No. 16—Hop Growing on the Pacific Coast of America) the account of hop growing on the Pacific Coast of the United States and Canada by Mr. Arthur Amos, M.A., which was published in the *Journal of the Board of Agriculture* for May, June, July and August, 1912. This pamphlet may be obtained at the office of the Board, 8 Whitehall Place, S.W., price 2*d.*, post free. Letters of application need not be stamped.

MISCELLANEOUS NOTES.

Duration of Buildings, &c., required for Small Holdings.

The Committee which was appointed by the President of the Board of Agriculture and Fisheries in February, 1912, to inquire and report as to the probable duration of the various classes and descriptions of buildings and other works required for the equipment and adaptation of land for small holdings in the various districts of England and Wales has presented its report (Cd. 6536, price 2½*d.*).

In order to obtain results of practical value with respect to the probable duration of such works the Committee made numerous inspections, in various counties in England and Wales, of the equipment of holdings on private estates, those provided by Local Authorities under the Small Holdings Acts not having been sufficiently long in existence to furnish reliable data. The results of these inspections are given in an appendix to the Report showing the nature of the building or work, the approximate age of the building, the material used in its construction, the cost of erection and maintenance (where they could be ascertained), and the present state of repair.

Timber Buildings.—Taking the cases only of those buildings of which the dates of erection could be precisely ascertained, the appendix shows that timber buildings which have been in existence for periods ranging from 20 to 80 years are in really good condition; and although the majority of those examined were erected on brick or stone footings, this was not invariably the case, some examples resting on the ground. Generally speaking, indeed, the Committee were impressed with the remarkably good state of preservation exhibited by both the fencing and a large proportion of these buildings; and, if reasonable attention be given to ordinary repairs, they consider that they should have many years of useful life left in them.

The chief points emphasised by the Committee with regard to buildings are that the tar coating on the exterior of farm buildings requires to be renewed from time to time if it is to remain effective; that the framework of oak or other home-grown timber, is as a rule, in excellent condition where the buildings themselves have been kept properly roofed and weather boarded; that the deal framing and weather boarding used in the more modern timber buildings appears to make a very durable covering, notwithstanding its tendency to warp and wind; that the omission to provide proper eaves-guttering occasions damage which unnecessarily increases the cost of repairs, and tends to shorten the life of the building; that the life of a building is considerably lengthened by erecting it on a brick, stone, or concrete plinth, carried up just above the level of the ground line; that corrugated iron is in some districts an excellent roofing material, but its use is to be deprecated in districts where the atmosphere may be impure, or on buildings where injurious chemical action is likely to be set up, and that the life of the iron will probably in any case be materially lengthened if it is kept covered with some such preservative as an oxide paint, tar, or tar varnish.

Fencing.—The Committee draw particular attention to three kinds of fencing, the results of the inspection of which were very favourable. These were: (1) A creosoted post and four-rail fence, erected 23 years ago by the roadside in the West Riding of Yorkshire, which is still in excellent condition; (2) Some oak fencing in Essex, 46 and 28 years old respectively; and (3) A short length of annealed wire fence with oak posts (tarred when erected), which was erected in Devonshire 18 years ago. The Committee were not very favourably impressed with an example of wire wove fencing seen in Sussex; although the fence had only been erected four years, nearly all the vertical wires were rusted, particularly at the point where they were twisted round the horizontal wires. Creosoted wooden posts seemed to be preferable to iron standards for wire fencing, particularly in cases where the fences are used in connection with horses and cattle.

Drains.—With regard to drains, it is stated in the Report that subsoil drains which have been properly laid and attended to remain efficient for a considerable number of years, and in one case pointed out to the Committee pipes which had been down for 40 years were in good working condition. The system of mole draining, which is carried out in some counties where the nature of the soil permits, was brought to the notice of the Committee, and in one field in Sussex, where this system was stated to have been completed about 25 years ago, the Committee were informed that most of the drains were still effective.

Changes in the Number and Size of Agricultural Holdings.

The number of agricultural holdings—*i.e.*, of separate occupations of agricultural land exceeding one acre in extent—was, in 1912, in England 374,809, and in Wales 61,077. The total, 435,886, for England and Wales was 576 more than in 1911, the increase being in holdings of from 5 to 300 acres, as appears in the following summary:—

Holdings Group.	England.		Wales.		England and Wales.		
	1911.	1912.	1911.	1912.	1911.	1912.	Inc. (+) or Dec. (-)
	No.	No.	No	No.	No.	No.	No.
Over 1 and not over 5 acres .	82,538	81,884	10,210	10,314	92,748	92,198	- 550
Over 5 and not over 50 acres	167,628	168,038	32,112	32,484	199,740	200,522	+ 782
Over 50 and not over 300 acres	110,110	110,657	17,965	17,937	128,075	128,594	+ 519
Over 300 acres	14,377	14,230	370	342	14,747	14,572	- 175
Total ...	374,653	374,809	60,657	61,077	435,310	435,886	+ 576

The reduction in the number of larger farms—exceeding 300 acres—still continues. Since 1905 628 of them have disappeared, being for the most part subdivided into smaller holdings. During the same period, holdings of 50 to 300 acres have increased by 1,088, holdings of 5 to 50 acres by 2,229, and holdings of 1 to 5 acres by 624. It would appear, therefore, so far as these returns may be regarded as representing separate occupations, that the number of persons occupying land in England and Wales has increased in the course of seven years by 3,313. It is to be remembered that, during that period the farmed area—"acreage under crops and grass"—has diminished by 231,000 acres, involving of necessity the extinction of a very large number of holdings. A net increase of the number of holdings into which the dwindling agricultural land is divided is consequently the more significant.

Although there is evidence of the gradual diminution in the number of the large farms in the country, they nevertheless still occupy a very considerable proportion of the land of the country. About 25 per cent. of the total farmed area is divided into farms exceeding 300 acres, while nearly 60 per cent. is taken up by medium farms of 50 to 300 acres. Small holdings of 50 acres and under, therefore, although forming over two-thirds of the total number of occupations, account for little more than 15 per cent. of the agricultural land of the country. The figures for England and Wales separately are shown in the table on the next page.

The difference between England and Wales is indicated in this statement. There are, in addition, wide divergencies between different counties; in Wiltshire 55 per cent., in Northumberland 49 per cent., and in Berkshire, Cambridge, Dorset, and Hampshire, about 47 per cent.

of the agricultural land is farmed in holdings of over 300 acres. On the other hand, in the whole of Wales (with the exception of Radnor), in Cheshire, Cornwall, Derbyshire, Lancashire, and Monmouth, not more than 10 per cent., and in Lancashire and half the Welsh counties less than 5 per cent., of the land is taken up by "large" farms.

Holdings Group.	England.		Wales.		England and Wales.	
	Acreage.	Per cent.	Acreage.	Per cent.	Acreage.	Per cent.
Over 1 and not over 5 acres .	250,314	1·02	34,550	1·25	284,864	1·05
Over 5 and not over 50 acres	3,341,291	13·69	663,334	24·03	4,004,625	14·74
Over 50 and not over 300 acres	14,187,416	58·11	1,927,275	69·83	16,114,691	59·30
Over 300 acres	6,635,472	27·18	135,038	4·89	6,770,510	24·91
Total . .	24,414,493	100·00	2,760,197	100·00	27,174,690	100·00

Importation Regulations.

Importation of Plants into Australia.—A Proclamation of December 4th, 1912, declares certain weeds and insect pests as "diseases" within the meaning of the Quarantine Act of 1908, and prohibits their introduction into Australia. Among the weeds scheduled are *Avena fatua* (Wild oat), *Bromus secalinus* (Rye-like Brome-grass, Chess), *Chenopodium album* (Goosefoot), *Cerastium vulgatum* (Mouse-ear chickweed), *Echium vulgare* (Viper's Bugloss, Blue weed), *Lychnis Githago* (Corn cockle), *Linum catharticum* (Purging flax), *Pteris aquilina* (Bracken, Brake fern), *Stellaria media* (Chickweed), *Thlaspi arvense* (Penny cress), and *Urtica urens* (Annual stinging nettle, Dwarf nettle). Under the Quarantine Act of 1908 diseased plants may be ordered into quarantine, and, if a source of danger to other plants, may be destroyed.

Importation of Hay, Straw and Peatmoss into the Isle of Man.—The importation into the Isle of Man of hay, straw and peatmoss from the United Kingdom is now permitted by an order of February 12th, 1913.

Export of Live Stock to South Africa.—The importation of cattle, sheep, goats, and pigs from the United Kingdom is now permitted into the Union of South Africa, under veterinary inspection, through the ports of Cape Town, Port Elizabeth, East London, and Durban, provided that the animals are accompanied by veterinary certificates indicating that the stock is free from any symptoms of infectious or contagious disease. Official export certificates from the Board of Agriculture and Fisheries are not required,* and inquiries relating to the export of live stock (including horses), as well as to the free transit of pedigree stock,* should be addressed to the High Commissioner for the Union of South Africa, 32, Victoria Street, London, S.W.

---

* *Journal of the Board of Agriculture*, January, 1913, p. 871.

Importation of Plants into Nyasaland.—The Plants Protection Ordinance of 1912 empowers the Governor in Council of the Nyasaland Protectorate by proclamation to prohibit the importation of plants, packings and other articles likely to be a means of introducing any plant disease. All plants and packages must be landed at Port Herald or such other place as may be substituted at any time, unless permission is given by the Governor in writing allowing the landing of plants, &c., elsewhere. On importation the plants, &c., will be disinfected for the purpose of destroying vegetable and insect pests. Where disinfection is not sufficient to destroy these pests, the plants may be destroyed. Provision is also made in the Ordinance for the inspection of plants growing in the Protectorate which have been imported.

Importation of Cattle into British Columbia.—An Order in Council of December 10th, 1912, prohibits the importation by common carrier into British Columbia of registered pure-bred cattle unless accompanied by a certificate, signed by an inspector, setting forth that within 30 days prior to the date of shipment, they have been submitted to, and have passed, the tuberculin test. (*Board of Trade Journal,* Jan. 16th, 1913.)

Importation of Animals into Sweden.—A decree of the Swedish Board of Health of January 2nd, 1913, permits the importation into Sweden by sea of cattle, sheep, goats, and other ruminant animals, pigs and equine animals, *viâ* the following towns:—Gothenburg, Haparanda, Helsingborg, Hernösand, Landskrona, Lulea, Malmö, Stockholm, Sundsvall, Söderhamm, Umea and Ornsköldsvik.

It should, however, be noted that importation of animals from the United Kingdom is still prohibited as a result of the outbreaks of foot-and-mouth disease in 1912.

Importation of Potatoes into Argentina.—The Board of Trade are in receipt, through the Foreign Office, of information to the effect that consignments of potatoes, in which one or more potatoes are found to be infected with the disease known as *Fusarium solani* (winter rot of potatoes) are refused admission into the Argentine Republic. Exporters in the United Kingdom should, therefore, be most careful in selecting potatoes for exportation to the Republic, whether for seed or other purposes. (*Board of Trade Journal,* Feb. 6th, 1913.)

Importation of Dogs into the Sudan.—The *Sudan Government Gazette* for December 28th, 1912, contains a notice of the Governor-General, dated December 10th, according to which dogs from countries free from rabies may be imported at Port Sudan on production of a permit in writing from the Director of the Sudan Veterinary Department, provided that such dogs are shipped on vessels sailing to Port Sudan and are not landed at any intermediate port, and that no other dogs are shipped at any intermediate port from a country which is not free from rabies. Importation is subject to such further conditions, if any, as the Director of the Sudan Veterinary Department may in each case think advisable to enforce. The notice further provides that the Director may in his discretion refuse a permit in any particular case. (*Board of Trade Journal,* Feb. 13th, 1913.)

---

* *Journal of the Board of Agriculture,* December, 1912, p. 783.

Notes on Agriculture Abroad.

Wheat from the East Africa Protectorate.—The *Bulletin of the Imperial Institute* for December, 1912, contains an interesting report on a sample of wheat forwarded to the Institute from the East Africa Protectorate. The wheat was stated to have been grown at the Kabete Experimental Farm in the Protectorate, and to represent the third crop from a purified and selected sample of North Russian wheat originally supplied to the East Africa Protectorate by the Imperial Institute for trial cultivation.

The sample consisted of clean, undamaged wheat, free from any admixture of foreign grain. The following table shows how the grain compared in physical characters with the selected North Russian wheat from which it was derived.

	Original wheat forwarded to the East Africa Protectorate.	Present sample grown at Kabete.
Size ...	... Small to medium	Medium
Colour	... Pale brown	Slightly dark brown
Appearance ...	Opaque to translucent	Translucent
Fracture	... Starchy to translucent	Translucent
Flour ...	... Fairly good white	A slightly better white

The two wheats were analysed with the following results:—

	Original wheat.	Present sample.
Moisture, *per cent.* ...	9·98	10·45
Gluten „ ...	10·2	11·5
Gliadin „ ...	4·88	5·66

The sample was submitted to the firm of merchants who furnished the original North Russian wheat which was forwarded to the East Africa Protectorate and sown at Kabete. The firm reported that the wheat was free from smut and weevil, had a thin skin, and gave a good yield of flour; the sample was too small for grinding and baking tests, but from its appearance they considered its present value to be 40*s.* to 41*s.* per 480 lb., c.i.f. United Kingdom ports (June, 1912). They added that if wheat similar in quality to the sample can be grown in commercial quantities it is certain that it would command a very good price in the United Kingdom.

Though the increase in the amount of gliadin is an undesirable feature, this increase is less than that of the total gluten, and on the whole this wheat has improved slightly under East African conditions. If it proves to be only slightly attacked by rust, as appears likely from the report on the third year's harvest, this wheat should be useful for extended cultivation in the East Africa Protectorate if it gives good yields there.

Agricultural Exhibition at Prague.—The Board are informed that the annual agricultural exhibition at Prague will take place this year at that city from 11th to 16th May. A copy of the programme (in French) may be seen at the office of the Board, 4 Whitehall Place, S.W.

Promotion of Agriculture by Private Effort in the United States and Canada.—An account has previously been given (see *Journal,* September, 1911, p. 495), of the assistance rendered by railway companies in the United States to agriculturists, chiefly through the establishment of experimental farms, the organisation of agricultural associations and the dissemination of information by means of agricultural instruction trains.

According to a report forwarded by H.M. Consul at Chicago, the International Harvester Company formed some two years ago a "Service Bureau" for the purpose of the development of agriculture in the United States and Canada. The Bureau carries on its work principally through the numerous agents of the Company; it distributes improved seed and scientific farming publications; it runs special seed maize trains, and arranges for personal demonstrations of farming methods.

The Company will no doubt benefit indirectly from the increased purchasing power of the agricultural community, and it is believed that the expenditure involved will eventually prove a good investment.

The Weather in England during February.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
Week ending Feb. 8th:	°	°	Inches.	Inches.		Hours	Hours.
England, N.E. ...	43·5	+4·8	0·29	−0·09	5	1·1	−0·8
England, E.	44·6	+6·2	0·25	−0·12	3	1·7	−0·8
Midland Counties ...	44·1	+5·5	0·53	+0·06	5	1·1	−1·1
England, S.E.... ...	46·2	+6·2	0·45	−0·07	4	1·4	−0·9
England, N.W. ...	44·6	+5·0	1·22	+0·60	7	0·7	−1·3
England, S.W. ...	46·0	+4·[illegible]	0·97	+0·21	6	1·2	−1·1
English Channel ...	48·7	+4·7	0·48	−0·16	4	1·8	−1·0
Week ending Feb. 15th:							
England, N.E.... ...	41·3	+2·9	0·21	−0·14	4	2·3	−0·3
England, E.	41·3	+3·1	0·18	−0·18	4	1·3	−1·5
Midland Counties ...	40·6	+2·2	0·30	−0·13	3	1·8	−0·6
England, S.E.	41·3	+1·6	0·15	−0·32	2	1·6	−1·0
England, N.W. ...	41·8	+2·5	0·33	−0·22	2	2·2	−0·2
England, S.W. ...	41·9	+0·9	0·18	−0·56	3	3·1	+0·5
English Channel ...	46·1	+2·2	0·05	−0·59	2	3·8	+0·5
Week ending Feb. 22nd:							
England, N.E. ...	37·2	−1·3	0·05	−0·28	2	2·9	+0·2
England, E.	37·0	−1·4	0·02	−0·31	1	4·3	+1·4
Midland Counties .	35·7	−2·8	0·02	−0·38	1	3·2	+0·7
England, S.E.... ...	36·2	−3·5	0·04	−0·39	1	4·6	+1·6
England, N.W. ...	37·3	−2·1	0·01	−0·51	1	3·9	+1·0
England, S.W. ...	35·8	−5·2	0·00	−0·68	0	4·9	+1·9
English Channel ...	39·5	−4·5	0·04	−0·56	1	4·5	+0·9
Week ending March 1st:							
England, N.E. ..	39·1	+0·4	0·19	−0·16	3	1·4	−1·6
England, E.	40·8	+2·0	0·18	−0·17	3	2·8	−0·3
Midland Counties ..	39·8	+1·0	0·17	−0·25	3	1·4	−1·3
England, S.E.... ...	4[illegible]·8	+1·8	0·13	−0·33	2	3·0	−0·1
England, N.W. ...	41·7	+2·2	0·16	−0·39	3	1·3	−1·5
England, S.W. ...	42·5	+1·5	0·39	−0·31	3	1·8	−1·4
English Channel ...	45·5	+1·7	0·21	−0·40	3	3·3	−0·5

Agricultural Conditions in England and Wales during February.

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales during February, state that the drier weather which prevailed during the latter part of the month has been of much benefit to the land, and the frosts have provided a much-needed check to the autumn-sown crops. The wheat now looks very well everywhere on all but low-lying and heavy lands; but on these, especially where they have been flooded, the plant is poor, or has in some instances perished, so that in a few localities some will be ploughed up; this applies perhaps more particularly in the northern half of the country. Wheat that was got in early still looks better than that sown late.

The recent dry, frosty conditions have enabled farmers to get on with spring cultivation, which was very generally impracticable, except on very light soils, during the first fortnight of February. Not much spring sowing has, however, as yet been carried out, except in the south, but with the continuance of dry weather it is anticipated that arrears will be rapidly cleared off.

Lambing has now become general in the central districts of England, with results that are more satisfactory than was the case with the earlier flocks in the south. The fall is mostly average, although a scarcity of twins is still commonly mentioned, but the lambs are generally reported healthy. In the south, where lambing is in many districts completed, the fall is hardly average, and there appears to have been considerable mortality among the ewes, particularly in the south-west, from liver-fluke or other causes induced by the prolonged wet season. In the north, prospects are regarded as satisfactory.

All classes of stock have derived benefit from the recent finer weather, and are making satisfactory progress.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for February, 1913, issued by the International Institute of Agriculture, gives the final returns of the production of the cereal crops last year in certain countries in the northern hemisphere, together with estimates of the acreage sown with winter cereals.

Hungary.—The production of wheat in 1912 amounted to 23,074,000 qr., which is less than in 1911 by 3·2 per cent. Rye totalled 6,610,000 qr., or 6·8 per cent. more than in 1911. Barley and oats both showed smaller productions than in 1911, barley amounting to 8,652,000 qr., or a decrease of 6·0 per cent., and oats 8,211,000 qr., or 16·7 per cent. less than in 1911. The production of maize was 24,026,000 qr., an increase on 1911 of 27·6 per cent.

Roumania.—The production of maize in 1912 is given as 11,938,000 qr., which shows a reduction on the previous year of 13·5 per cent.

Sowing of Winter Cereals.—The areas estimated to have been sown with *wheat* up to December 31st, 1912, compared with the areas sown during the corresponding period of 1911, expressed as percentages, are now given as follows:—Belgium, Denmark, France, Luxemburg, Switzerland, Japan, and Tunis, 100; Spain, 99; England and Wales, 95;

Scotland, 90; Roumania, 60; Canada, 94; United States, 97; and India, 102. The areas sown with *rye* are:—Denmark, Norway, and Switzerland, 100; Belgium, 102; Spain, 95; France, 103; Luxemburg, 99; Roumania, 70; and United States, 99. The areas sown with *barley* are:—Belgium, 109; Spain, 112; France, 95; Luxemburg, 135; Roumania, 97; Switzerland, Japan, and Tunis, 100; and to *oats*:—Spain, 97; France, 103; and Tunis, 100.

Argentina.—An estimate of the harvest of maize in 1912–13 places the production at 22,958,000 qr., which is less than in 1911–12 by 33·5 per cent.

Sugar Beet.—The final returns show the production in Roumania in 1912 to have amounted to 285,000 tons, an increase on 1911 of 10·3 per cent.; in Sweden to 823,000 tons, or 13·3 per cent. less than in 1911; and in the United States to 4,519,000 tons, which is greater than in 1911 by 25·1 per cent.

Live Stock in Germany.—The preliminary results of the census of live stock taken on December 2nd, 1912, give the number of horses as 4,516,297, compared with 4,345,047 on the same date in 1907; of cattle as 20,158,738, compared with 20,630,544; of sheep as 5,787,848, compared with 7,703,710; of pigs as 21,885,073, compared with 22,146,532; of goats as 3,383,971, compared with 3,533,970; and of poultry as 82,474,317, compared with 77,103,045.

Live Stock in Hungary.—The number of horses is returned as 1,960,000 in 1912, compared with 2,000,611 in 1911; of cattle as 6,036,945, compared with 6,183,424; of sheep as 7,168,054, compared with 7,696,881; of goats as 313,849, compared with 331,383; and of pigs as 7,409,801, compared with 6,415,197.

Live Stock in United States.—The Crop Reporting Board of the Bureau of Statistics estimate that on January 1st, 1913, there were on farms and ranges in the United States 20,567,000 horses, compared with 20,509,000 on the same date in 1912; 20,497,000 milch cows, compared with 20,699,000; 36,030,000 other cattle, compared with 37,260,000; 51,482,000 sheep, compared with 52,362,000; and 61,178,000 pigs, compared with 65,410,000. (H.M. Embassy, Washington, Feb. 3rd.)

Russia.—According to information received from 72 Governments of European and Asiatic Russia by the Central Statistical Committee of the Ministry of the Interior, the depth of snow was fully sufficient, and the sowings covered quite satisfactorily in only 20 Governments. As much depends on the extent and depth of the snowfall, the first half of the winter of 1912–13 cannot be regarded as having been favourable for the winter crops. In the majority of Governments, including most of the wheat and other grain-growing regions of European Russia, almost all Poland, and certain Governments of Trans-Caucasia, the snow fell later than usual, and the sowings were insufficiently covered. (*H.M. Ambassador, St. Petersburg,* February 16th.)

Tasmania.—The Government Statistician, in a forecast issued on January 9th, estimates the yield of wheat for the current season (1912–13) at 446,307 bush., compared with 659,615 bush. in 1911–12; of Cape barley at 15,669 bush., compared with 20,590 bush.; of barley at 196,270 bush., compared with 127,419 bush.; of oats at 2,306,143 bush., compared with 1,504,633 bush.; of hay at 176,023 tons, compared with 107,684 tons; and of potatoes at 86,138 tons, compared with 62,164 tons.

Canada.—The *Census and Statistics Monthly* of December last contains a report on the field crops of Canada for the year ending December 31st, 1912. In comparison with 1911 the results of last year's harvest, both as regards total yield and value, are, upon the whole, inferior. The average prices realised for most of the crops were somewhat less, and the yields from wheat, peas, beans, and maize were also lower. On the other hand, oats yielded about 13½ million bush. more; and barley, rye, buckwheat, mixed grains, flax, potatoes, turnips, and other roots, maize, fodder, sugar-beet, and alfalfa also gave more or less greater yields than in 1911. The quality of the crops, as shown by the average weight per bushel, was somewhat inferior in the case of wheat, rye, peas, mixed grains, and flax, but was superior in the case of oats, barley, buckwheat, beans, and maize. The final estimates of production in 1912 are as follows (*in bushels*):—Autumn wheat, 16,396,000; spring wheat, 182,840,000; total wheat, 199,236,000; oats, 361,733,000; barley, 44,014,000; rye 2,594,000; peas, 3,773,500; buckwheat, 10,193,000; mixed grains, 17,952,000; flax, 21,681,500; beans, 1,040,800; maize, 16,569,800; potatoes, 81,343,000; and turnips and other roots, 87,505,000. Grass and clover yielded 11,189,000 tons of hay; maize fodder, 2,858,900 tons; sugar-beet, 204,000 tons; and alfalfa, 310,100 tons.

Spain.—The production of wheat in 1912 is officially estimated at 13,719,186 qr., compared with 18,556,847 qr. in 1911; of barley at 7,197,316 qr., compared with 10,412,233 qr.; of oats at 2,361,919 qr., compared with 3,471,718 qr.; of rye at 2,200,559 qr., compared with 3,370,426 qr.; and of maize at 2,923,974 qr., compared with 3,350,897 qr. (*Journal Officiel* (France), March 3rd.)

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on March 1st, 1913, certain diseases of animals existed in the countries specified:—

Austria (for the period February 12th—19th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 182 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period January 1st—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (3 outbreaks in 3 communes), Rabies.

Bulgaria (for the period September 14th—21st).

Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Swine Fever.

Denmark (month of January).

Anthrax, Swine Erysipelas.

France (for the period February 2nd—8th).

Anthrax, Blackleg, Foot-and-Mouth Disease (157 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period February 1st—15th).
Foot-and-Mouth Disease (68 infected places in 43 parishes), Glanders and Farcy, Swine Fever.

Holland (month of January).
Anthrax, Foot-and-Mouth Disease (16 outbreaks in 7 provinces), Foot-rot, Glanders and Farcy, Swine Erysipelas:

Hungary (for the period February 5th—12th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 9 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period February 3rd—9th).
Anthrax, Blackleg, Foot-and-Mouth Disease (2,324 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period June 15th—July 1st).
Glanders and Farcy.

Norway (month of January).
Anthrax.

Rumania (for the period January 14th—21st).
Anthrax, Dourine, Rabies, Sheep-pox, Sheep-scab.

Russia (month of October).
Anthrax, Foot-and-Mouth Disease (15,272 animals in 251 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period September 14th—21st).
Sheep-pox, Swine Fever.

Spain (month of November).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (595 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of January).
Anthrax, Blackleg.

Switzerland (for the period February 17th—23rd).
Anthrax, Blackleg, Foot-and-Mouth Disease (104 "étables" entailing 1,216 animals, of which 15 "étables" were declared infected during the period), Swine Fever.

Agricultural Labour in England during February.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in February:—

Labourers not on the regular farm staff lost a little time through bad weather in most districts in the early part of the month. There was a fair demand for drainers in a number of districts, and, as the state of the land improved towards the end of the month, for men to assist in carting operations. Threshing, hedging, and ditching also offered a moderate amount of employment for extra men. Though generally the supply of such men was sufficient, some scarcity was reported in several districts. Men for permanent situations were also reported as scarce in certain districts, particularly in the Midland and Southern and South-Western counties.

Increases of £1 or more for the quarter were reported at the Candlemas hiring fairs held in Cumberland.

Districts in which there was some scarcity of extra men included parts of the Cockermouth (*Cumberland*), Whiston (*Lancashire*), Leyburn (*Yorkshire*), Blyth-and-Cuckney (*Nottinghamshire*), Melton Mowbray (*Leicestershire*), Evesham (*Worcestershire*), Monks Kirby; Rugby, and Southam (*Warwickshire*), Daventry, Oundle, Potterspury, and Wellingborough (*Northamptonshire*), Banbury (*Oxfordshire*), Hitchin (*Hertfordshire*), Eaton Socon (*Bedfordshire*), Downham (*Norfolk*), Samford (*Suffolk*), Braintree and Tendring (*Essex*), Bridge (*Kent*), Winchester (*Hampshire*), Pewsey (*Wiltshire*), Cirencester (*Gloucestershire*), and Newton Abbot (*Devonshire*) Rural Districts.

A surplus of extra men was reported in the Patrington (*Yorkshire*), Hayfield (*Derbyshire*), Buntingford (*Hertfordshire*), Wisbech (*Cambridgeshire*), Thetford (*Norfolk*), Mildenhall (*Suffolk*), Rochford (*Essex*), Elham (*Kent*), Epsom (*Surrey*), Thakeham (*Sussex*), Hartley Wintney (*Hampshire*), and Blandford and Wareham-and-Purbeck (*Dorset*) Rural Districts.

Men for permanent situations were reported as in demand in the following Rural Districts:—Norton (*Yorkshire*), Shardlow (*Derbyshire*), Blyth-and-Cuckney (*Nottinghamshire*), Oswestry (*Shropshire*), Wellingborough (*Northamptonshire*), Banbury (*Oxfordshire*), St. Neots (*Huntingdonshire*), Downham (*Norfolk*), Wangford (*Suffolk*), Saffron Walden (*Essex*), Petworth (*Sussex*), Chippenham and Pewsey (*Wiltshire*), Taunton and Williton (*Somerset*), Chipping Sodbury, Cirencester, and Dursley (*Gloucestershire*), Newton Abbot and Tavistock (*Devonshire*), and West Penwith (*Cornwall*).

THE CORN MARKETS IN FEBRUARY.

C. KAINS-JACKSON.

Wheat.—A fortnight's frost helped the market from the 12th to the 26th, but the first ten days of the month belonged to a mild weather period of small requirements for actual consumption, and before February was out, two mild and spring-like days intervened, stopping all advancing tendencies on the exchanges, which on the average of the month as a whole showed but little net price change. Indian wheat was as much as two shillings per qr. dearer, but then the exhaustion of old crop supplies on spot, and the reduced expectations of the new harvest were causes combining to make holders of stored grain raise their demands. English wheat was not dearer on the month, neither was American, and for new Argentine prices were accepted which showed a decline of two shillings from the level at which the old crop, alone available in January, had then closed. A pivotal price of 36*s.* 6*d.* per 480 lb. for American Red winter wheat argued little real change in average milling wheat. The country averages for English ranged from 27*s.* to 33*s.* at the leading markets, and there were rather more markets above the thirty shilling level than below it. A considerable percentage of poultry corn came to market, and the increasing demand for wheat for chicken feed leads to larger market sales of a grade which used to be consumed upon the farm. The mean price of English wheat for the first half of the current cereal year worked out at about 1*s.* 4*d.* below the average for the like period of the previous season. In view of the difficult harvest of 1912 the depreciation in value cannot be called excessive. Imports in round numbers were twelve and a half million quarters, against ten and a half millions in the preceding campaign, but the deliveries from farmers for the 26 weeks were gravely below those of 1911–12, and the stocks in fifteen chief ports at the end of the month did not exceed 1,900,000 qrs. of foreign grain. The market therefore was not suffering from congestion of supply. Shipments from Argentina were pressed forward during February at the rate of half a million quarters weekly. For the month 2,075,000 qr. were shipped. This represents a large trade even for a good shipping year, but the figures are by no means unprecedented. North America shipped 1,219,000 qr., a good total, but which came as a relief to spot holders after experiencing shipments of 2,120,000 qr. in January. As with more ports open than usual Russia shipped 700,000 qr. only, the Russian shippers must either be dissatisfied with prices or have been restricted in their operations by the want of supplies from the interior. Australia was able to send off 827,000 qr. of her new wheat crop, which was about what had been expected. Shipments of 268,000 qr. from India were small, but considering war and other limitations, 474,000 qr. exported from S.E. Europe was quite a good total. The last day of February saw almost exactly three million quarters of wheat on passage, which was less than at the same date in 1912, but in itself a very fair expectation.

Flour.—London millers combined on the advent of frost to put up prices 6*d.* per sack, and they were still maintaining the enhanced quotation when the frost had given place to a comparatively high temperature. Trade was not so active as they expected even during the frosty fortnight, and it was decidedly lacking in vigour as the month passed away. North America increased its shipments during February, and the total for the month was 646,000 sacks against 525,000 in January. On the last day of the month there were 264,000 sacks on passage. American flour, which Mark Lane speaks of briefly as Bags (it is sold in the 140 lb. bag, English in the 280 lb. sack) has remained quite stationary in price, the quotations being only 30*s.* 6*d.* for finest Minneapolis named, 28*s.* 6*d.* for fine Minnesota, and 26*s.* for second Minnesota. In Kansas 26*s.* 6*d.* was paid. Canadian flour closed the turn in buyers' favour, 27*s.* 6*d.* accepted for very fine grade Manitoba, and 25*s.* 3*d.* to 25*s.* 9*d.* for the fair average type known as "Export Grade."

Barley.—During the month the local averages for English varied by as much as 16*s.* 11*d.* per quarter, one market averaging 21*s.* 11*d.*, while another made the handsome price of 38*s.* 6*d.* Sales of English showed an increase, and the wide price range was explained by certain markets reporting a good inquiry for seed corn and malting type, while others, owing to the comparative dearness and scarcity of Russian feeding, were clamorous for English of the grinding description, and not very particular as to discoloration or any harvest damage short of downright mustiness. The inquiry for seed barley at Mark Lane and elsewhere gives reason to hope that full sowings are now taking place. Imports for February were below the average, and, as they included Californian brewing, the total of the feeding type was perhaps a bare half of what the trade required. Prices, therefore, continued to range from 26*s.* to 29*s.* for 400 lb., which is a charge that makes barleymeal, as pig-feeders complain, unduly expensive. The month's shipments were 484,000 qr. from California, 1,040,000 qr. from Russia, and 36,000 qr. from India. There are only 540,000 qr. on passage to the United Kingdom, a total, arguing that Continental inquiry for the quantities shipped has been above the average.

Oats.—Rising values for English during February did not quite suffice to lift the half-yearly average to "a level sovereign." Still, 19*s.* 10*d.* is sufficiently near the desired goal to mark the first half of the present cereal year as one very fairly favourable to the home grower. Some excellent prices have been made during the last four weeks, good seed corn exceeding 30*s.* per qr., and the same price being paid by well-to-do horse-owners for Scotch oats of the 1911 yield. The imports have been fairly heavy, but nothing surprising, and the quantity on passage, 510,000 qr., is only remarkable when we compare it with an average month. Making the comparison with the end of February in any ordinary year, it is moderate enough, for this is the period when the total on passage is apt to be at its highest. February shipments were 359,000 qr. from North America, 1,342,000 qr. from South America, 510,000 qr. from Russia, and 8,000 qr. from Roumania. Both Argentina and Russia appear to have very large export surpluses of very light and inferior oats, while the British markets want plenty of the cereal but are shy of anything below 304 lb. natural weight, or of husk exceeding 20 per cent. of the whole grain.

Maize.—Although the new crop in Argentina is only now being secured, there was a preliminary estimate issued by the Argentine Government on February 19th, and according to this the crop is nearly ten million quarters below the yield of 1912. It was not expected that the bumper crop of 1912 would be repeated, but the falling off is remarkable, and counted during the last week of the month as a decided "bullish" influence. After the husking we may look for more reliable returns. The price of maize has varied little of late, the ordinary sorts ranging from 25*s.* to 27*s.* per qr., while fine small round touches forty shillings per quarter. The steady demand for African fails to elicit supply. Shipments for February were 1,247,000 qr. from North America, 6,540,000 qr. from South America, and 41,000 qr. from the European countries shipping round corn. There were 530,000 qr. on passage on the last day of the month. Imports for the first half of the cereal year were, in round numbers, six and a half million quarters, which argues a very liberal demand. The inquiry for actual weekly wants is admitted on all the chief markets to have been above the average.

Oilseeds.—Shipments of linseed for the first two months of 1913 were about 1¼ million quarters as compared with 700,000 qr. and 650,000 qr. for the first two months of 1912 and 1911. This striking difference sufficed to account for the remarkable difference in prices. Cargoes of Argentine at the end of the month were obtainable for 44*s.* as compared with 60*s.* per qr. a year previously, and 71*s.* 6*d.* two years ago. Cottonseed has appreciated in price, and at 9*s.* 3*d.* to 9*s.* 6*d.* per cwt. is quite above the ideas of the average buyer. There is a great call for an increased production of cottonseed in Egypt, the Soudan, and in

East and West Africa, and, in default of supply from these regions, Peru, Brazil, and tropical South America in general are being turned to. Some excellent samples have come to hand, both from Peru and Brazil, but at present there is little bulk behind them. Poppyseed and sesame are oil seeds which would both sell well if the prices were not so exceedingly high.

Various.—Rice is cheaper on the month, especially for the useful feeding types shipped to us from Rangoon. Beet sugar has been a good steady sale, and closed at 9*s.* 10*d.* per cwt. English beans fit for splitting have made 35*s.*, but soft samples have been parted with for thirty shillings. Good maple peas at 37*s.*, and Dun at 34*s.* have had a steady sale. Indian small pulse continues to command an excellent market, and 28*s.* for Muttor and 31*s.* for Gram are in truth attractive quotations. The war in the Near East has driven canaryseed up to the fancy price of £5 per quarter, but this is due to intending buyers believing week after week that the war would be over almost immediately, and postponing purchases until the fulfilment of contracts became very difficult. The value is expected to drop by one-half within a month of hostilities ceasing, and in any case some relief will shortly be to hand from La Plata, which offers new crop for prompt shipment at 90*s.*, cost freight and insurance to London.

THE LIVE AND DEAD MEAT TRADE IN FEBRUARY.

A. T. MATTHEWS.

Fat Cattle.—The trade has been steady throughout the month, with prices showing a gradual, though only a slight, advance. Though they now stand at a comparatively high level, they are still considerably below the maximum touched last June, when prime Shorthorns in English markets averaged 9*s.* 6*d.* per stone. It is now much easier than it was in the past to trace the causes of market movements in live stock, as we have the statistics of supplies placed before the public in handy form, side by side with the averages of recent years, and an examination of these figures at the present time reveals a very adequate reason for the rather high range of values. This is found in the fact that in nearly forty English markets the supplies for many weeks have been more than 3,000 below the average.

The average prices recorded for the various breeds in English markets during February were as follows:—Shorthorns, 9*s.* and 8*s.* 3*d.* for first and second quality against 8*s.* 11*d.* and 8*s.* 2*d.* in January; Herefords, 9*s.* 1*d.* and 8*s.* 6*d.*, against 9*s.* and 8*s.* 6*d.*; Devons, 9*s.* 1*d.* and 8*s.* 4*d.*, against 8*s.* 11*d.* and 8*s.* 1*d.*; Welsh Runts, 9*s.* 2*d.* and 8*s.* 4*d.*, against 9*s.* and 8*s.* 3*d.*; Polled Scots, 9*s.* 4*d.* and 8*s.* 9*d.*, against 9*s.* 3*d.* and 8*s.* 5*d.* per stone of 14 lb.

A notable feature of the month was the reappearance in English markets of Irish cattle in fairly large numbers. Their condition has been moderately good, but their value at home was too high to admit of a very profitable business for dealers.

A large proportion of the cattle on offer at Islington have been smaller and younger than usual.

Veal Calves.—There has been an improved demand for fat calves of good quality, of which the supplies have been none too large. The average prices for the month were 9¾*d.* and 8¾*d.* per lb. for first and second quality, against 9½*d.* and 8½*d.* in January. These figures, of course, take no account of the large numbers slaughtered prematurely, which are of extremely inferior quality.

Fat Sheep.—A shortage in supplies to English markets of 56,000 in seven weeks tells its own tale, and advancing prices are the inevitable result. Still, averages are barely equal to those of the highest point touched last spring. They are, however, gradually rising, and few people seem to consider that the extreme point has yet been reached. Downs, in February, in about 23 markets, averaged 10*d.*, 9¼*d.*, and 7¼*d.* per lb. for the three qualities; Longwools, 9¾*d.* 8¾*d.*, and 7*d.*; prime Cheviots, 11¼*d.*, and prime Crossbreds, 10*d.* These prices are fully ¼*d.* per lb. higher than those of January. The top price for both Downs and Crossbreds has been exceptionally high at certain markets. For instance, Downs made 11*d.* per lb. at Hereford and Crossbreds 11¼*d.* at Preston. Cheviots, too, have been quoted at 1*s.* per lb. at Penrith for several weeks. In the same week at other markets the best Downs made only 9¼*d.*, and Crossbreds 9¼*d.*

Fat Lambs.—These at present are sparingly offered, but prices are no higher than usual at this time of year. With the present values of both mutton and store sheep, there will be every inducement this year to hold back the lambs.

Fat Pigs.—Bacon pigs remain at a premium, and during February prices continued to rise by almost imperceptible degrees, the average advancing exactly 1*d.* per stone every week. In about 27 markets handy weights of first quality averaged 8*s.* 4*d.* per 14 lb. stone, and heavier pigs 7*s.* 10*d.* In many markets 8*s.* 9*d.* was realised, and 8*s.* 11*d.* has been paid at Salford.

Carcass Beef—British.—Trade in the London dead-meat markets has been singularly uniform and rather dull all the month. Sellers have complained of great slackness in the demand, and prices have not appreciably altered from those of January. Scotch short sides averaged 4*s.* 9*d.* and 4*s.* 6*d.* for first and second quality, long sides 4*s.* 6*d.* and 4*s.* 4*d.*; English 4*s.* 4*d.* and 4*s.* 2*d.*; Irish 4*s.* 2*d.* and 4*s.* per 8 lb. stone. In the second week there was a sharp demand for coarser qualities, with the singular result that Scottish long sides made as much as short.

Chilled Beef.—Argentine chilled beef has met a much better trade than in January, and it is stated that cattle are making more money in their own country than a year ago. Prices have advanced in London by 6*d.* per stone for hindquarters, and 1*d.* for fores. The averages for the former were 3*s.* 5*d.* and 3*s.*, and for the latter, 2*s.* 6*d.* and 2*s.* 4*d.*

Frozen Beef.—The trade in frozen beef has attracted little attention, and prices often maintain practically a dead level for weeks together. New Zealand makes about 1*d.* per stone more than Argentine and Australian, and averaged in February 2*s.* 4*d.* to 2*s.* 6*d.* for hinds and 2*s.* to 2*s.* 2*d.* for fores.

Carcass Mutton—Fresh Killed.—More small Scottish "Hill" sheep have been on offer. These weigh about 30 lb., and have sold at relatively high prices, occasionally as much as 6*s.* per stone. Scotch sheep of 6½ to 7 stones have averaged about 5*s.* 4*d.* per 8 lb. English mutton is not well represented in the dead-meat market, extremely little of the primest quality being consigned there. During the month, however, it made nearly as much as the larger Scotch, but its value was not in accordance with live market quotations.

Frozen Mutton.—The trade has been quiet and featureless, and prices just the turn easier than in January. New Zealand averaged 3*s.* 3*d.* and 2*s.* 11*d.* per 8 lb. for first and second quality; Argentine, 2*s.* 11*d.* and 2*s.* 8*d.*, and the little Australian offered made similar rates.

Lamb—Fresh Killed.—Very small supplies were on the market, but prices remained moderate at 7*s.* 4*d.* to 8*s.* per stone, and occasionally 8*s.* 4*d.*

Frozen Lamb.—There is about the usual demand for New Zealand lamb, and the best new season has made 4*s.* 6*d.* to 4*s.* 8*d.* per stone, and old season 3*s.* 11*d.* Australian fetches 3*s.* 6*d.* to 3*s.* 8*d.*, and Argentine 3*s.* 4*d.* to 3*s.* 6*d.*

Veal.—Good quality veal has continued scarce and has fetched from 5*s.* 4*d.* to 6*s.* for Both English and Dutch. Plenty of small carcasses have been on offer at nominal prices.

Pork.—Supplies have again been moderate, and the demand steady at 4*s.* 8*d.* to 5*s.* 4*d.* for English, and about 3*d.* less for Dutch.

THE PROVISION TRADE IN FEBRUARY.

HEDLEY STEVENS.

Bacon.—Although the consumptive demand has not been large during the month, it has been sufficient to prevent any accumulation of stocks, the imports being still comparatively small. With the present abnormally high prices making bacon a luxury it is a surprise to dealers that the demand keeps so good. Even at these extreme prices curers at home and abroad assert that, with present prices of the raw material, they cannot make a fair profit.

American packers write that their home trade continues good, and they are still considerably short of stocks in cellars for this time of year, when they usually hold a surplus of bacon and hams in course of curing for their summer consumption. Stocks of short rib middles in the cellars of the Chicago packers at the end of the month were 3,900,000 lb., against 24,190,000 lb. at the same time last year. In Canada there is still a short supply of pigs, and recent cables report further advances, which would bring the cost of their cured long sides to 76*s.* to 78*s.*, delivered in England. In consequence of these high prices the Canadian packers are shipping very small quantities to England, as they can find an outlet for their reduced output in Canada. At Chicago during the month the receipts of hogs have been a little heavier, and prices have ranged from $7.40 to $8.70, against $5.85 to $6.50 last year, and $6.75 to $7.85 two years ago. At the end of the month imported long sides were realising from 11*s.* to 13*s.* per cwt. above last year's figures for February, and some cuts of American bacon and hams from 18*s.* to 21*s.* per cwt. above.

English pigs continue to command very high prices, and curers find it difficult to secure sufficient supplies. With prices so high in the

Lenten season, the outlook for the summer trade, from a profit standpoint, is not too bright for the curer.

Cheese.—Trading in cheese has again been unsatisfactory, the high prices causing all dealers to operate cautiously, as the shipments from New Zealand continue large. Stocks of Canadians here are not large, but Canada is reported to hold about 50,000 more cheese than last year, and English dealers holding small stocks assert that present prices cannot be maintained. Complaints are general as to the scarcity of really fine quality cheese, presumably brought about by the poor keeping qualities of those manufactured during a wet season. This especially applies to English cheese, and in some districts, especially the west of England, farmers still hold fair stocks of irregularly flavoured Cheddars, for which it is feared they will eventually have to accept lower prices.

Stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 157,000 boxes, against 139,000 boxes at the end of February, 1912, and 210,000 boxes in 1911. Stocks of New Zealand cheese in London and Bristol for the same period were 26,800, 16,200, and 32,000 crates (two cheese per crate) respectively.

Butter.—This article of food has also sold very slowly during the month, the demand being chiefly for best goods, and by the end of the month this description was held for a little more money, but dealers operate sparingly.

The consumptive demand for secondary qualities has been very small, presumably on account of the mild weather and the larger consumption of margarine. Secondary imported lots range from 16*s.* to 18*s.* per cwt., and choicest from 10*s.* to 14*s.* per cwt. below those current at same time last year.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in February and January, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	February.		January.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
Fat Stock:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 4	8 9	9 3	8 5
Herefords	9 1	8 6	9 0	8 6
Shorthorns	9 0	8 3	8 11	8 2
Devons	9 1	8 4	8 11	8 1
Welsh Runts	9 2	8 4	9 0	8 3
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	9¾	8¾	9½	8½
Sheep:—				
Downs	10	9¼	9¾	8¾
Longwools	9¾	8¾	9½	8¼
Cheviots	11¼	10¼	10½	9½
Blackfaced	11	10	10¼	9½
Welsh	10	9¼	9¾	9
Cross-breds	10	9¼	9¾	8¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	8 4	7 10	8 1	7 7
Porkers	8 9	8 3	8 6	7 11
Lean Stock:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	24 4	20 4	24 7	20 13
„ —Calvers... ...	23 2	19 7	23 12	20 9
Other Breeds—In Milk ...	21 2	17 18	20 2	17 12
„ —Calvers ...	—	15 15	—	14 5
Calves for Rearing	2 9	1 17	2 9	1 17
Store Cattle:—				
Shorthorns—Yearlings ...	11 0	9 10	10 19	9 9
„ —Two-year-olds...	15 4	13 3	15 4	13 11
„ —Three-year-olds	18 10	16 6	18 7	16 7
Herefords —Two-year-olds	17 1	15 2	16 18	15 0
Devons— „	16 0	13 14	15 15	13 17
Welsh Runts— „	16 10	14 10	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	48 6	42 9	46 10	40 8
Store Pigs:—				
8 to 10 weeks old	22 6	17 11	20 8	16 3
12 to 16 weeks old	34 9	26 9	32 0	24 8

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in FEBRUARY, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—						
English	1st	60 0	60 0	57 0	61 6	58 6
	2nd	56 0	57 6	53 6	59 0	55 6
Cow and Bull	1st	52 0	55 0	49 0	48 0	51 6
	2nd	45 0	49 6	43 0	43 0	46 6
Irish : Port killed	1st	—	57 0	57 0	59 0	56 0
	2nd	—	52 6	52 6	57 0	50 0
Argentine Frozen—						
Hind Quarters	1st	34 6	34 0	35 0	34 6	35 0
Fore „	1st	30 0	30 6	29 6	29 6	30 6
Argentine Chilled—						
Hind Quarters	1st	46 0	45 0	44 6	48 0	45 0
Fore „	1st	34 6	34 0	33 0	34 6	34 0
Australian Frozen—						
Hind Quarters	1st	34 0	33 0	32 6	33 6	32 6
Fore „	1st	30 6	30 6	29 6	29 0	29 6
VEAL :—						
British	1st	88 6	76 0	86 6	84 0	84 6
	2nd	74 6	71 0	76 6	73 6	78 6
Foreign	1st	—	—	—	85 0	—
MUTTON :—						
Scotch	1st	—	—	85 6	77 0	87 6
	2nd	—	—	81 6	71 6	83 0
English	1st	74 6	76 0	81 0	73 6	83 0
	2nd	63 6	71 0	76 6	69 0	77 0
Irish : Port killed	1st	—	—	81 0	—	81 6
	2nd	—	—	76 6	—	76 6
Argentine Frozen	1st	41 0	42 6	43 6	41 0	43 6
Australian „	1st	37 0	38 6	36 6	41 0	36 6
New Zealand „	1st	—	—	—	45 0	—
LAMB :—						
British	1st	112 0	112 0	—	113 0	—
	2nd	102 6	—	—	102 6	—
New Zealand	1st	61 6	58 6	63 6	63 6	63 6
Australian	1st	54 0	51 6	51 6	52 0	51 6
Argentine	1st	53 6	53 0	53 6	48 6	54 0
PORK :—						
British	1st	73 6	73 6	76 6	74 6	76 6
	2nd	69 0	70 0	69 6	67 6	71 6
Foreign	1st	—	—	—	71 0	—

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended (*in* 1913).	WHEAT.						BARLEY.						OATS.					
	1911.		1912.		1913.		1911.		1912.		1913.		1911.		1912.		1913.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 4 ...	30	5	33	2	30	5	23	11	33	3	28	6	17	0	20	7	19	10
,, 11 ...	30	8	33	1	30	3	23	10	33	0	28	4	17	2	20	8	19	2
,, 18 ...	30	11	33	4	30	5	24	4	33	3	28	6	17	4	20	11	19	4
,, 25 ...	30	11	33	7	30	11	24	5	33	1	28	10	17	3	21	1	19	4
Feb. 1 ..	30	9	33	8	31	1	24	5	32	10	28	11	17	5	21	3	20	2
,, 8 ..	30	5	34	0	31	0	24	6	33	2	28	10	17	5	21	4	20	1
,, 15 ...	30	3	34	4	30	9	24	7	32	10	29	1	17	6	21	7	20	2
,, 22 ...	30	2	34	6	30	11	24	9	32	8	28	8	17	7	21	9	20	7
Mar. 1 ...	30	0	34	1	31	0	25	0	32	0	28	6	17	5	21	6	20	4
,, 8 ...	30	1	34	1	31	3	25	0	31	7	28	5	17	5	21	8	20	0
,, 15 ...	30	1	34	0			24	11	31	2			17	6	21	8		
,, 22 ...	30	2	34	1			25	0	31	10			17	5	21	9		
,, 29 ...	30	3	34	4			24	11	30	3			17	5	21	8		
Apl. 5 ...	30	4	34	10			24	7	30	9			17	7	21	11		
,, 12 ..	30	3	35	4			25	2	30	2			18	3	22	1		
,, 19 ...	30	4	36	7			25	5	29	11			17	10	22	4		
,, 26 ...	30	11	37	10			25	5	30	4			18	3	22	9		
May 3 ...	31	4	38	1			25	7	30	2			18	6	23	1		
,, 10 ...	31	8	37	11			25	1	31	1			19	0	23	7		
,, 17 ...	32	6	37	8			25	4	31	2			19	2	23	7		
,, 24 ...	32	8	37	2			25	0	31	1			19	5	23	7		
,, 31 ...	32	5	36	10			24	10	30	0			19	5	23	9		
June 7 ...	32	4	36	11			25	7	29	11			19	7	24	0		
,, 14 ...	32	3	37	0			23	11	30	8			19	8	23	10		
,, 21 ...	31	11	37	5			23	9	30	8			19	10	24	0		
,, 28 ...	31	10	37	10			24	5	30	2			19	9	23	11		
July 5 ...	32	1	38	2			25	10	31	7			19	9	23	11		
,, 12 ...	32	3	38	3			25	10	30	2			19	11	24	1		
,, 19 ...	32	5	38	10			24	3	30	9			19	5	24	8		
,, 26 ...	32	5	38	9			23	8	30	9			19	7	23	4		
Aug. 2 ...	32	0	38	4			24	4	28	6			18	2	22	2		
,, 9 ...	31	6	39	2			26	9	30	7			18	0	22	4		
,, 16 ...	31	6	38	2			27	8	28	3			17	10	21	8		
,, 23 ...	31	8	35	6			28	10	28	1			18	0	20	10		
,, 30 ...	31	7	34	10			28	4	28	6			18	3	20	8		
Sept. 6 ...	31	10	35	1			28	4	29	9			18	1	21	8		
,, 13 ...	32	0	33	5			29	0	29	0			18	5	20	5		
,, 20 ...	32	4	32	7			29	11	29	6			18	9	19	10		
,, 27 ...	32	6	31	7			30	5	29	9			19	1	19	5		
Oct. 4 ...	32	7	31	8			30	9	29	7			19	5	19	8		
,, 11 ...	32	9	31	10			31	0	30	4			19	10	19	5		
,, 18 ...	32	9	32	2			31	5	30	11			19	11	19	9		
,, 25 ...	33	1	33	1			31	7	31	6			20	6	19	10		
Nov. 1 ...	33	4	33	4			31	10	31	10			20	8	20	1		
,, 8 ..	33	4	33	1			32	7	31	11			20	11	19	11		
,, 15 ...	33	1	32	10			32	10	31	2			21	0	19	9		
,, 22 ...	33	0	32	1			33	5	30	11			20	10	19	11		
,, 29 ..	32	10	31	9			33	10	30	8			20	11	19	8		
Dec. 6 ...	32	9	31	0			34	0	29	11			20	9	19	6		
,, 13 ...	32	11	30	8			33	5	29	2			20	9	19	3		
,, 20 ...	32	9	30	7			33	5	28	11			20	8	19	1		
,, 27 ...	33	0	29	10			33	4	28	6			20	7	19	2		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1912.	1913.	1912.	1913.	1912.	1913.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France:	January	44 4	47 2	28 8	30 4	22 9	24 0
	February	45 9	47 3	29 4	30 2	23 2	23 11
Paris:	January	46 11	48 9	28 8	31 3	23 5	23 11
	February	47 4	47 6	29 0	31 0	24 7	23 6
Belgium:	January	34 5	34 7	29 7	30 5	23 10	22 8
Germany:	January	44 7	—	36 2	—	26 11	—
Berlin:	January	45 3	43 0	—	—	27 0	24 0
Breslau:	January	40 2	37 10	32 10* 28 0†	29 5* 26 9†	25 2	21 10

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of February, 1912 and 1913.

—	WHEAT.		BARLEY.		OATS.	
	1912.	1913.	1912.	1913.	1912.	1913.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London...	35 2	31 5	33 4	30 3	23 4	23 3
Norwich	33 8	31 7	33 0	27 6	21 7	20 8
Peterborough	33 3	28 5	32 1	27 3	21 9	17 2
Lincoln...	33 3	29 0	32 0	29 6	21 4	18 2
Doncaster	33 5	28 10	31 10	27 6	20 10	19 7
Salisbury	34 1	30 9	34 8	31 2	21 9	20 10

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in February, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	16 0	15 0	—	—	17 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	114 0	110 0	—	--	—	—
,, Factory	102 6	90 6	103 0	93 0	—	—
Danish	—	—	131 0	128 0	130 0	128 0
French	—	—	—	—	133 0	127 0
Russian	110 0	106 0	109 6	106 6	111 6	109 6
Australian	112 0	110 0	111 6	109 6	114 6	110 6
New Zealand	118 6	116 0	117 6	115 6	118 6	115 6
Argentine	113 0	111 0	113 0	110 0	111 0	108 6
CHEESE :—						
British—						
Cheddar	75 6	70 6	75 0	72 0	77 0	71 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	82 0	77 0	84 0	79 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	65 0	61 0	64 6	62 0	64 6	63 0
BACON :—						
Irish	77 6	74 6	74 0	70 0	77 6	74 6
Canadian	73 0	70 0	70 0	67 0	73 0	71 0
HAMS :—						
Cumberland	—	—	—	—	111 0	107 0
Irish	—	—	—	—	105 6	101 0
American (long cut)	71 0	68 0	71 6	69 0	71 0	68 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	13 6	12 1	—	—	13 1	12 3
Irish	12 0	11 6	12 3	11 4	11 4	10 4
Danish	—	—	12 4	11 7	12 9	10 7
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.
Edward VII.	100 0	85 0	80 0	—	101 0	88 6
Langworthy	110 0	95 0	95 0	90 0	120 0	110 0
Up-to-Date	95 6	88 6	78 6	73 6	95 6	85 6
HAY :—						
Clover	105 0	90 0	114 6	93 6	131 6	104 0
Meadow	100 0	80 0	—	—	118 0	97 0

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY	
	1913.	1912.	1913.	1912.
Anthrax :—				
Outbreaks	53	114	103	206
Animals attacked	55	132	116	234
Foot-and-Mouth Disease :—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy) :—				
Outbreaks	15	11	28	23
Animals attacked	29	15	90	46
Parasitic Mange :—				
Outbreaks	337	462	677	1,110
Animals attacked	659	921	1,483	2,712
Sheep-Scab :—				
Outbreaks	44	51	89	114
Swine-Fever :—				
Outbreaks	121	254	267	483
Swine Slaughtered as diseased or exposed to infection ...	1,155	3,771	3,136	6,311

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1913.	1912.	1913.	1912.
Anthrax :—				
Outbreaks	—	—	—	1
Animals attacked .	—	—	—	1
Foot-and-Mouth Disease :—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy) :—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange :—				
Outbreaks	27	12	64	20
Sheep-Scab :—				
Outbreaks	84	72	161	158
Swine-Fever :—				
Outbreaks	10	10	34	21
Swine Slaughtered as diseased or exposed to infection ...	62	46	161	192

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Salop County Council.—A Survey of the Soils and Agriculture of Shropshire. (98 pp. + map.) Shrewsbury, n.d. [63(42); 63.111.]

East Anglian Institute of Agriculture, Chelmsford.—Report on Field Experiments. (31 pp.) 1912.

Agee, A.—Crops and Methods for Soil Improvement. (246 pp.) New York: The Macmillan Co., 1912. 5*s.* 6*d.* net. [63.11(02); 63.16(02).]

Green, J. J.—A First Book of Rural Science. (144 pp.) London: Macmillan & Co., 1913. 1*s.* 6*d.* [63(022).]

New Zealand, Department of Agriculture.—Bull. 21 (New Series):—Impure Seed. (7 pp.) Wellington, N.Z., 1912. [63.1951.]

Auld, S. J. M., and *Edwardes-Ker, D. R.*—Practical Agricultural Chemistry. (243 pp.) London: John Murray, 1913. 5*s.* net. [54(02).]

India, Department of Agriculture.—Memoirs. Bacteriological Series. Vol. I. No. 1:—Studies in Bacteriological Analysis of Indian Soils. No. 1, 1910–11. (65 pp.) Calcutta, 1912. [63.115.]

*Rural Education Conference.**—Seventh Report. Manual Instruction in Rural Elementary Schools and the individual examination of children in Rural Elementary Schools. [Cd. 6571.] (23 pp.) London: Wyman & Sons, 1913. 2½*d.* [37(42); 372.]

Call, L. E., and *Schafer, E. G.*—A Laboratory Manual of Agriculture for Secondary Schools. (344 pp.) New York: The Macmillan Co., 1912. 4*s.* net. [371.]

Wisconsin Agricultural Experiment Station.—Bull. 221:—Getting the Most Profit from Farm Manure. (34 pp.) Madison, Wisconsin, 1912. [63.163.]

Purdue Agricultural Experiment Station.—Bull. 157:—Unproductive Black (Peat) Soils. (233–264 pp.) [63.142.] Circ. 31:—Small Seed Improvement. (15 pp.) [63.1951.] Circ. 33:—Liming the Soil. (16 pp.) [63.15.] Lafayette, Indiana, 1912.

Lamont, Norman.—Problems of the Antilles: A Collection of Speeches and Writings on West Indian Questions. (178 pp. + map.) London: Simpkin, Marshall & Co., 1912. 2*s.* 6*d.* net. [63(729).]

*K. Danske Landhushholdnings Selskab.**—Beskrivelse af Landbrugets Udvikling i Danmark fra 1835 indtil Nutiden. (7 vols. and supplements.) (4386 pp.) Kobenhavn, 1895 to 1912. [63(489).]

Field Crops—

North Dakota Agricultural Experiment Station.—Bull. 100:—Cropping Systems for Wheat Production. (63 pp.) Fargo, N.D., 1912. [63.311.]

Cornell Agricultural Experiment Station.—Bull. 317:—Further Experiments on the Economic Value of Root Crops for New York. (545–568 pp.) Ithaca, N.Y., 1912. [63.332.]

India, Memoirs of the Dept. of Agriculture.—Botanical Series, Vol. V., No. I.:—On the Inheritance of some Characters in Wheat. I. (46 pp. + 111 plates.) Calcutta, 1912. [63.311.]

Bangor, University College of N. Wales.—Bull. No. II., 1912:—Mixtures of Grass and Clover Seeds (Sown 1909). (12 pp.) [63.33(*b*).] Bull. No. IV., 1912:—The Growth of Sugar-Beet. (4 pp.) [63.3432.] Bull. No. VI., 1912:—Manuring of Mangels. (7 pp.) [63.332.] Bull. No. VIII., 1912:—Growth of Linseed. (4 pp.) [63.342.] Bangor, 1912.

U.S. Department of Agriculture, Bureau of Plant Industry.—Bull. 260:—The American Beet-sugar Industry in 1910 and 1911. (73 pp. + 2 maps.) Washington, 1912. [63.3432.]

U.S. Senate. Document No. 890.—Sugar at a Glance. The Influence of Sugar-Beet Culture on Agriculture, and its Importance in Relation to National Economics. (63 pp.) Washington, 1912. [63.3432.]

States of Jersey, Technical Instruction Committee.—Report on Field Experiments in 1912. (36 pp.) Jersey, 1913. 2*d*.

East Suffolk County Education Committee.—Circ. 9, 1913:—Report on the Results of the Experiments carried out on the Farms of Farmers throughout the County during the Season 1912. (20 pp.) Ipswich, 1913.

Horticulture—

U.S. Department of Agriculture, Bureau of Chemistry.—Bull. 160:—A study of nuts with special reference to microscopic identification. (37 pp. + 4 plates.) Washington, 1912. [63.41(*d*)*i*]

New Zealand, Department of Agriculture.—Bull. 17 (New Series):—Cool Storage of Fruit. (7 pp.) Wellington, N.Z., 1912. [63.41-198.]

Plant Diseases—

Utah Agricultural Experiment Station.—Bull. 110:—The Alfalfa Leaf-Weevil (*Phytonomus murinus*, Fab.). (17-72 pp.) Logan, Utah, 1910. [63.27.]

U.S. Department of Agriculture, Bureau of Entomology.—Tech. Ser. No. 16, Pt. V.:—Papers on Coccidæ or Scale Insects: The Genus Fiorinia in the United States. (73-82 pp. + plate.) Washington, 1912. [63.27.]

U.S. Department of Agriculture, Bureau of Plant Industry.—Bull. 265:—Some factors influencing the efficiency of Bordeaux Mixture. (29 pp.) Washington, 1912. [63.295.]

Truffant, G.—Les Ennemis des Plantes Cultivées. (565 pp.) Paris, 1912. 8*s*. [63.2(02).]

New York State Department of Agriculture.—Bull. 39:—The Inspection, Certification, and Transportation of Nursery Stock in New York State, other States, and Canada. (1475-1493 pp.) [63.292(7).] Bull. 41:—Wart Disease of the Potato. (41-51 pp.) [63.24.] Albany, 1912.

India, Department of Agriculture.—Memoirs. Entomological Series. Vol. IV., No. 4:—Life-Histories of Indian Insects.—IV. (*Hymenoptera.*) (183-267 pp.) Calcutta, 1912. 2 Rs. [59.57.]

Bruck, W. F.—Plant. Diseases. [Translated by *J. R. Ainsworth-Davis.*] (152 pp.) London: Blackie & Son, 1912. 2*s*. net. [63.2(02).]

Klebahn, H.—Grundzüge der allgemeinen Phytopathologie. (147 pp.) Berlin: Gebrüder Borntraeger, 1912. (63.2(02).]

West Virginia Agricultural Experiment Station.—Bull. 137:—The Chestnut Bark Disease. (209-225 pp.) Morgantown, W. Va., 1912. [63.24-49.]

Bangor, University College of N. Wales.—Bull. No. V. of 1912:—Potatoes: Effect of Spraying. (4 pp.) Bangor, 1912. [63.24-33.]

Mississippi Agricultural Experiment Station.—Technical Bull. 2:—Some Scale Insects of Mississippi with notes on Certain Species from Texas. (78 pp.) Agricultural College, Mississippi, 1911. [63.27.]

Tennessee Agricultural Experiment Station.—Bull. 95:—Notes on Tomato Diseases with results of Selection for Resistance. (12 pp.) Knoxville, Tennessee, 1912. [63.24-51; 63.513.]

Live Stock—

*Board of Agriculture and Fisheries.**—Report of the Committee on the Improvement of Mountain and Moorland Breeds of Ponies. (41 pp.) London: Wyman & Sons, 1912. 6*d*. [63.61.]

Purdue Agricultural Experiment Station.—Circ. 29:—Live Stock Judging for Beginners. (128 pp.) Lafayette, Indiana, 1912. [63.6(064).]

[Books may be borrowed from the Board's Library on certain conditions, which may be ascertained on application. The volumes marked * are not available for lending.]

(877). P. 10—9. 6,000. 3/13. R. C. & S., Ltd.

INDEX TO VOL. XIX.

(APRIL, 1912, TO MARCH, 1913.)

[*NOTE.—References to Insects and Fungi are indexed under the headings "Insects" and "Fungi" only, to Weeds under the heading "Weeds" only, to Diseases of Animals under the heading "Diseases of Animals" only, and to Import and Export Regulations under the heading "Import Regulations" only.*]

The names of the research and experiment stations at which the principal experiments summarised in the *Journal* have been conducted are indicated in italics, thus:—(*Rothamsted*). In the case of experiments conducted abroad, the name of the country is given.

Articles or reports on the following subjects appear in the *Journal* each month and are not separately indexed:—Notes on the Weather, Notes on Agricultural Labour in England, Notes on Crop Conditions in England and Wales, Notes on Crop Prospects Abroad, Reviews of the Corn Markets, the Live and Dead Meat Trade, and the Provision Trade, Prices of Agricultural Produce, Outbreaks under the Diseases of Animals Acts, Prevalence of Animal Diseases on the Continent, Lists of Additions to the Board's Library, and Selected Contents of Periodicals.

PAGE

Aberford pig club ... 944
Afforestation, see *Forestry*.
Africa (see also *South Africa*):
  Agricultural machinery in Portuguese East Africa ... 414
Agricultural estates belonging to the Crown... 694
Agricultural Organisation Society, reconstitution of ... 693
Agricultural output of Great Britain ... 308, 325, 399, 567
  ,, ,, Ireland... 754
Agricultural research, see *Research*.
Agricultural returns and statistics:
  Acreage and live stock returns, 1912 (Part I, 1912) ... 1047
  Area under crops and number of live stock, 1912 ... 505
  Colonial and foreign statistics, 1910 (Part IV, 1910) ... 64
  ,, ,, ,, 1911 (Part V, 1911)... 955
  Hops, acreage in 1912 ... 594
  Imports and exports of agricultural produce, 1911 (Part IV, 1911) 499
  ,, ,, ,, ,, in 1911 and 1912 ... 499, 838
  Prices of agricultural produce, 1911 (Part III, 1911) ... 410
  Produce of corn, pulse and hay crops in 1912 ... 700
  ,, hops in 1912 ... 699
  ,, potato and root crops, 1912 ... 784
  Year-book of agricultural statistics of International Agricultural Institute ... 598
  Scotland, Area under crops and number of live stock, 1912 ... 785
    Produce of corn, pulse and hay crops in 1912 ... 874
    ,, potato and root crops in 1912 ... 875
Agricultural teachers, conference at Cambridge, July, 1912 ... 360
Algeria, agricultural machinery in ... 64
Allotments, see *Small Holdings*.
Amos, Arthur: Hop-growing on the Pacific coast of America 89, 187, 293, 378, 1047

PAGE
Amos, H.: Potato harvest in Lincolnshire and Cambridgeshire in 1912 . 698
Apples, see *Fruit.*
Argentina, live stock census, 1910 ... 248
    Potatoes in... ... 502
Armstrong, S. F.: Seed analyses, their interpretation and use ... 827
Auckland, agricultural exhibition in 1913–14 ... 782
Auld, S. J. M.: The formation of prussic acid from linseed cake and other feeding stuffs ... 446
Australia:
  State manufacture of agricultural implements in Western Australia 414
Austria-Hungary:
  Budget of Austrian Ministry of Agriculture for 1912 ... 243
  ,, Hungarian Department of Agriculture for 1912... ... 243
  Co-operative cattle and horse insurance in Austria ... 951
  Development of agriculture in Hungary ... 588
  Live stock census in Hungary, 1911 ... 70
  ,, ,, ,, 1912 ... 1055
  ,, ,, in Croatia and Slavonia, 1911 ... 157
  Organisation of the sale of live stock in Austria ... 691
  Prague agricultural exhibition, 1913 ... 1052
  State aid to agriculture in Austria ... 959
  Vienna, Adriatic exhibition, 1913 ... 960

Bacteriology (see also *Dairying—Milk* and *Soils*):
  Inoculation of red clover (*Devon*) ... 228
  Micro-organisms, effect of electricity on ... 233
Bang, Prof. B.: Foot-and-Mouth disease ... 624
Barley (see also *Crops*):
  Varieties (*Aberdeen*) ... 51
  ,, (*Chelmsford*) ... 314, 1030
  ,, (*East Suffolk*) ... 1031
  ,, (*Norfolk*) ... 937
  Weather, influence on (*Germany*) ... 223
  United States, cost of producing ... 238
Beans, manuring (*Leicester*) ... 759
Beef, see *Meat.*
Bees:
  Isle of Wight bee disease (see also *Journal Supplement, No.* 8) ... 133
  ,, Weather, influence on ... 140
Beet, see *Sugar Beet.*
Belgium, agricultural co-operation in 1910 ... 868
  Encouragement of horse breeding ... 502
  Farm schools ... 1014
  Ghent international agricultural exhibition in 1913... ... 782
    Admission of articles for ... 587
  Ghent, tenth international congress of agriculture ... 501, 955
Birds:
  Food (*H. & Agric. Soc.*)... ... 231
  ,, (*Camb.*) ... 496
  ,, enquiry by the Board of Agriculture and Fisheries ... 954
  ,, of nestling birds ... 460
  Grouse disease ... 371
  Protection of newly-sown corn from birds (*Nantwich and Acton Grammar School*) ... 138
Blackbird, food of nestlings ... 463
Board of Agriculture and Fisheries:
  Agricultural Holdings Act, 1913 ... 1028
  Agricultural output of Great Britain ... 308, 325, 399, 567
  Agricultural returns and statistics, see *Agricultural Returns.*
  Animals division report, 1911 ... 581
  Animals (landing from Ireland) Order of 1913 ... 1040
  Butter, imported, percentage of curd ... 750
  Courses in agricultural colleges, report of Rural Education Conference ... 128
  Destruction of wood pigeons ... 954
  Development Fund grants, see *Development Fund.*

Board of Agriculture and Fisheries—*continued.* PAGE
  Ensilage, notice as to ... 499
  Food of birds enquiry ... 954
  Foot-and-mouth disease, report of committee ... 218
    Landing of Irish store cattle in England ... 581
    Notice as to hay and straw used for packing ... 1039
    Outbreaks ... 323, 409, 497, 580, 693, 775, 870, 952
  Fritfly, notice as to damage to oats ... 482, 1046
  Geological Survey, memoir ... 233
  Grants for agricultural education and research, 1911–12, report ... 1016
  Grants for agricultural instruction, circular letter ... 498
  Horse breeding, see *Live Stock—Horses.*
  Horse breeding branch, preliminary report ... 392
  Horticultural branch, vacancy for a general inspector ... 777
  Hydrocyanic acid from linseed cake, experiments ... 657
  Intelligence division report, Part I., 1911 ... 234
  Land division report, 1911 ... 220, 234
  Leaflets ... 952
  Market prices, weekly return ... 955
  Manual instruction in rural elementary schools, report of Rural Education Conference ... 957
  Ordnance maps, reproduction of ... 870
  Parasitic Mange Order of 1911 ... 737
  Ponies, improvement of mountain and moorland breeds ... 955
  Poultry rearing in Cheshire ... 721, 902
  Research scholarships in agricultural science, awards ... 499
  Scheme for agricultural research and technical advice for farmers 1025
  Seeds, quality of ... 930
  Small holdings:
    Circular letter as to loans for equipment and adaptation ... 694
    Duration of buildings, etc., for small holdings, report of committee ... 1047
    Report of proceedings for 1911 under the Small Holdings and Allotments Acts ... 234
  Special research grants ... 1046
  Sugar beet cultivation, report of experiments on, in 1911... 134, 152
  Tithe, &c. Acts, report of proceedings of Board under, in 1911 ... 153
  Tuberculosis, bovine, enquiry as to ... 152
    Circular letter as to... 1043
  Turning out of entire animals on commons ... 324
  Veterinary officers, committee on employment of ... 498
    Report of committee ... 931
  Wart disease of potatoes, Order of 1912 ... 62
    Warning as to ... 327
Bordeaux mixture, see *Spraying.*
Borlase, W.: The study of agricultural seeds ... 529
Bradshaw, A.: The thatching of ricks ... 300
Brazil, agricultural development in ... 416
  Agricultural experiment stations in ... 244
Bredon pig club ... 582
Brenchley, Winifred E.: Weeds in relation to soils ... 20
  Yellow Rattle as a weed on arable land ... 1005
Brown, W.: Experimental work in artificial incubation ... 909
Buildings: Duration of buildings for small holdings ... 1047
  Premiums for construction of farm buildings in Italy ... 504
Butter, see *Dairying.*

Calcium cyanamide, see *Manures.*
Cambridge, conference of agricultural teachers, 1912 ... 360
Canada:
  Cost of producing crops ... 590
  Dairy industry, statistics of ... 587
  Export of cattle to France ... 503
  Hop growing on Pacific coast ... 89, 187, 293, 378, 1047
  Promotion of agriculture by private effort ... 1052
Cattle, see *Live Stock.*
Census of Production Act, 1906, report on enquiries under 308, 325, 399, 567, 754

PAGE

- Cheese, see *Dairying.*
- Chickens, see *Poultry.*
- Chile :
  - Nitrate production ... 593
- Chrysanthemums, partial sterilisation of chrysanthemum-sick soils ... 824
- Cider, see *Fruit—Apples.*
- Clover, inoculation of red (*Devon*) ... 228
  - Mixtures of seeds (*Bangor*) ... 51
  - Purity and germination of seeds ... 728, 930
  - Sickness ... 928
  - Varieties (*Denmark*) ... 759
- Collinge, W. E. : The food of nestling birds... ... 460
- Commissions and Committees :
  - Development Commission, see *Development Fund.*
  - Duration of buildings, &c., for small holdings, report of committee... ... 1047
  - Foot-and-mouth disease, report of committee ... 218
  - Mountain and moorland breeds of ponies, report of committee ... 955
  - Veterinary officers, committee on employment of ... 498
    - Report of committee ... 931
- Commons Act, 1908, order under, relating to the turning out of entire animals on the Eppynt Hills, Breconshire ... 324
- Conferences and Congresses :
  - Agricultural teachers, conference of, at Cambridge, July, 1912 ... 360
  - Agriculture, tenth international congress at Ghent... ... 501, 955
  - Electroculture, congrès at Rheims, 1912 ... 501
  - Forestry congress at Paris, 1913 ... 960
  - Rural education conference ... 126, 957
- Co-operation and Credit :
  - Agricultural co-operative credit societies and joint stock banks ... 897
  - ,, credit and co-operation in England and Wales ... 43
  - ,, Organisation Society, reconstitution of ... 693
  - Allotments societies ... 49, 584
  - Cow Clubs :
    - Co-operative insurance of cows in 1910 ... 116
    - ,, ,, ,, 1911 ... 763
    - Prees cottagers' cow club ... 388, 1035
    - Wem cow club ... 946
  - Credit Societies :
    - Credit, agricultural, in England and Wales ... 43
    - Credit societies, agricultural co-operative, in England and Wales in 1911 ... 862
    - Hedge End agricultural credit society ... 37
    - Whissonsett small holders' credit society ... 773
  - Development Commissioners' report, 1911–12 ... 778
  - Development of agricultural co-operation in Great Britain ... 569
  - Insurance, agricultural co-operative, in England and Wales ... 46
  - Pig Clubs :
    - Aberford pig club ... 944
    - Bredon pig club ... 582
    - Kemerton and Overbury pig club... ... 209
    - Management of a pig club ... 944
    - Pig clubs in England and Wales in 1910... ... 203
    - ,, ,, ,, ,, 1911... ... 679
    - Welland High Bridge pig club, Spalding ... 1036
  - Purchase, production and sale, agricultural co-operative, in England and Wales... ... 48
  - Small holdings societies ... 49, 584
  - *Austria*, co-operative cattle and horse insurance ... 951
    - Organisation of the sale of live stock ... 691
  - *Belgium*, agricultural co-operation in 1910 ... 868
  - *France*, agricultural credit banks in 1911 ... 1036
  - *Germany*, agricultural co-operation in... ... 311
  - *India*, co-operative credit in ... 947
  - *Russia*, zemstvo credit banks ... 950
- Corn (see also *Crops*, *Wheat*, &c.).
  - Effect of competition on elimination of plants (*U.S.*) ... 574

Corn—*continued.* PAGE
Imports of grain in the cereal year 1911–12 476
Improvement of cereals 360
Produce of crops in 1912 700
Protection of newly-sown corn from birds (*Nantwich and Acton Grammar School*) 138
Cost of producing barley and potatoes in the United States 238
Cost of production of crops in Canada 590
Cost of production of milk 926
Credit, see *Co-operation.*
Crops (see also *Wheat*, *Barley*, *Agricultural Returns*, *&c.*, "Crop Conditions in Great Britain" and "Notes on Crop Prospects Abroad" in each issue).
Area under crops in England and Wales, 1912 ... ... 505, 1047
„ „ „ Scotland, 1912 785
Corn, pulse and hay crops, produce in England and Wales, 1912... 700
„ „ „ „ „ Scotland, 1912 874
Forecasts of total production in 1912 ... ... 420, 508, 596
Fruit crops abroad 331
Hops 422, 510, 598, 699, 703, 965
Acreage in England and Wales in 1912 594
Produce „ „ „ „ 699
Insurance against damage to crops by hailstorms 1009
Potatoes 509
Produce of England and Wales, 1912 784
„ Scotland, 1912... 875
Root crops, produce of, in England and Wales, 1912 784
„ „ „ „ Scotland, 1912 875
Sugar beet... ... ... 69, 330, 420, 509, 597, 703, 788, 877, 964, 1055
Argentina 69
Australia 598
Austria, potatoes 510
Belgium:
Fruit 334
Canada 156, 248, 421, 590, 703, 789, 1056
Potatoes 510
France 247, 878, 965
Fruit 333
Potatoes 510
Germany 69, 157, 248, 421, 509, 597, 878
Fruit 331
Potatoes 509
Holland 157, 597
Fruit 334
Potatoes 510
Sugar beet production in 1911 247
Hungary 421, 509
Potatoes 510, 597, 703
India 69, 965
Wheat crop estimate, 1912 248
Italy 965
Potatoes 510
New South Wales 69, 509
Norway 422, 965
Potatoes 510
Prussia 788
Roumania 69
Russia 69, 156, 247, 509, 597, 788, 965, 1055
Sugar beet 248
Spain 597, 1056
Sweden 420
Tasmania 70, 1055
United States 69, 156, 248, 331, 421, 598, 789, 878
Fruit crops in California 157
Potatoes 510
Crowther, Charles: The feeding of farm stock 9, 106, 196, 265
Cruciferæ, susceptibility of various kinds to finger-and-toe disease ... 668
Cucumbers, treatment of cucumber-sick soils 822

PAGE

- Dairying:
  - Butter:
    - Curd, percentage of, in imported butter ... 750
    - Temperature of pasteurisation for butter making (*U.S.*) ... 404
    - Tinned butter, market for, in Venezuela ... 416
  - Cheese:
    - Bacteriology of cheddar cheese (*U.S.*) ... 1032
    - Losses in pressing and ripening ... 761
    - Yellow discoloration of Stilton cheese ... 177
    - Yield ... 761
  - Cream, factors affecting richness of cream obtained from separators (*U. S.*) ... 760
  - Dairy cattle: Cost of keeping ... 926
    - Feeding, see *Feeding Stuffs.*
    - Supply of ... 3, 617
  - Milk: Bacteriological content, some factors affecting (*Edin.*) ... 940
    - Composition of ... 407
    - Composition, variation in, with advance of lactation (*Leeds*)... 229
    - Condensed milks, results of bacteriological analyses ... 139
    - Cost of production ... 926
    - Influence of fatness of cow at parturition on the percentage of fat in the milk (*U. S.*) ... 857
    - Iron content (*Germany*) ... 857
    - Milk records, value of ... 6
    - ,, ,, (*Lancs. C.C.*) ... 760
    - ,, ,, (*Scottish Milk Records Com.*) ... 1031
    - Milk tests (*Lancs. C.C.*) ... 760
    - Machines, milking, tests of (*France*) ... 139
    - Pasteurisation, temperature for butter making (*U.S.*) ... 404
    - Production of clean milk on two large dairy farms ... 923
    - Root feeding, heavy, effect on yield and composition of milk (*Edinburgh*) ... 404
    - Tuberculosis, bovine, enquiry as to ... 152
      - Circular letter as to ... 1043
      - Probable effect of control of milk supply on infantile tuberculosis (*Manchester*) ... 406
    - Variation in milk production, cause of (*U.S.*) ... 677
  - *Canada*, statistics of dairy industry ... 587
  - *Great Britain*, dairy produce of ... 484
  - *Norway*, statistics of dairy industry ... 592
  - *Venezuela*, market for tinned butter ... 416
- Denmark:
  - Budget of Ministry of Agriculture ... 593
  - History of foot-and-mouth disease ... 633
- Development Fund:
  - Agricultural research, 1911-12, report on grants ... 1016
    - Scheme for agricultural research and technical advice for farmers ... 1025
    - Scholarships in agricultural science, awards ... 499
    - Special research grants ... 1046
  - Forestry, grant from fund in respect of provision of technical advice in ... 1
    - Divisions of England and Wales for provision of technical advice ... 850
  - Grants for agricultural instruction, circular letter ... 498
  - Horse breeding, preliminary report on grant for ... 392
  - Report of Development Commissioners, 1911-1912 ... 777
- Dewponds ... 18
- Diseases of Animals:
  - Animals' division of the Board, report, 1911 ... 581
  - Cattle plague, misuse of term ... 497
  - Foot-and-mouth disease ... 624
    - History of the disease in various countries ... 631
    - Landing of Irish store cattle in England ... 581
    - Necessity for drastic action ... 627
    - Notice as to hay and straw used for packing ... 1039
    - Outbreaks ... 323, 409, 497, 580, 693, 775, 870, 952
    - Report of committee on ... 218

PAGE

- Diseases of Animals—*continued.*
  - Symptoms of the disease ... 624
  - Ways in which the disease is transmitted ... 639
  - *Denmark*, history of the disease ... 633
  - Horse poisoning by *Equisetum arvense* ... 229
  - Johne's disease ... 444, 490
  - Joint ill in newly-born animals... 550
  - Navel ill in newly-born animals ... 550
  - Parasitic mange in horses, asses and mules ... 732
    - Order of 1911... 737
  - Redwater fever ... 363, 490
  - Scour in calves, feeding sour milk as a remedy (*Germany*) ... 861
  - Sheep scab ... 489
  - Tuberculosis, bovine, enquiry as to ... 152
    - Circular letter as to... 1043
    - Probable effect of control of milk supply on infantile tuberculosis (*Manchester*) ... 406
  - Veterinary officers, departmental committee on employment of ... 498
    - Report of committee ... 931
  - *Germany*, measures against tuberculosis of cattle ... 65
    - Prevalence of animal diseases in 1911 ... 872
- Diseases of Plants, see *Plant Diseases*, *Insects* and *Fungi.*
- Dry Farming:
  - Hop cultivation in America by dry farming methods ... 191

- East Africa Protectorate, analysis of sample of wheat from ... 1052
- Education:
  - Agricultural teachers, conference at Cambridge, July, 1912 ... 360
  - Courses in agricultural colleges, report of Rural Education Conference on ... 126
  - Development Commissioners, report 1911-12 ... 777
  - Farm schools in France, Germany and Belgium ... 1014
  - Grants for agricultural instruction, circular letter ... 498
  - Manual instruction in rural elementary schools, report of Rural Education Conference ... 957
  - Report on grants for agricultural education and research, 1911-12 1016
  - Research scholarships in agricultural science, awards ... 499
  - Scheme for agricultural research and technical advice for farmers 1025
  - Special research grants ... 1046
- Eggs (see also *Poultry*).
  - Egg production of hens at different ages (*U.S.*) ... 492
  - Improvement of egg produced on farm (*U.S.*) ... 494
- Electricity in agriculture:
  - Congress, international, at Rheims, 1912 ... 501
  - Micro-organisms, effect of electricity on (*Brit. Assoc.*) ... 233
  - Seeds, germinating, influence of electricity on respiration (*Brit. Assoc.*)... 140
- Ellis, Rupert: British-grown tobacco... 904
- Ellmore, W. Paulgrave: Preparation of willows for market ... 277
- Ensilage, notice as to ... 499
- Europe:
  - Poultry farming in ... 241
- Exhibitions: Auckland, New Zealand, agricultural exhibition, 1913-1914 782
  - Ghent, international agricultural exhibition, 1913 ... 782
    - Admission of articles into Belgium for ... 587
  - Hague, international agricultural exhibition, 1913 ... 783
  - Khabarovsk, agricultural and industrial exhibition, 1913 ... 413
  - Panama-Pacific international exhibition, 1915 ... 501
  - Paris, exhibition of horses and donkeys, 1912 ... 235
  - Prague agricultural exhibition, 1913 ... 1052
  - Rostov-on-Don, agricultural exhibition, 1912 ... 413
  - St. Petersburg, international horticultural exhibition, 1913 587, 961
  - Stallions, thoroughbred, show, 1912 and 1913 ... 62, 142, 175
  - Vienna, Adriatic exhibition in 1913 ... 960
- Experimental error:
  - Application of statistical methods to the interpretation of experimental results ... 367
  - Probable error in pig feeding trials (*Camb.*) ... 674

PAGE
Experiments and summaries of experiments (see under the subject):
  Experiment stations in Uruguay and Brazil 244
Export regulations, see *Import and Export Regulations.*
Exports of agricultural produce 499, 845

Farm Institutes, see *Education.*
Feeding Stuffs: Animal nutrition 365
  Bullocks, fattening (*Norfolk*) 940
  Cake, manurial value of (*Norfolk*) 60
  Cattle feeding experiments (*Norfolk*) 60
  Cattle feeding 835
    Rations for 106
    Young cattle and calves, rations for 196
  Compounding of rations 9
  Dairy cows, rations for 106
    Coconut cake for milch cows (*Wye*) 578
    Effect of various foodstuffs on milk secretion and fat content (*Germany*) 578
    Helianthi as a food for dairy cows (*France*) 761
    Specific effect of foods on milk production (*Germany*) ... 579
  Ensilage, notice as to 499
  Ether extracts of hays and fodders, composition and digestibility (*U.S.*) 856
  Farm stock, feeding of 9, 106, 196, 265
  Furze or gorse 670
  Helianthi for dairy cows (*France*) 761
  Horses, rations for 269
  Linseed, growth of (*Bangor*) 135
  „ „ (*Essex*) 223
  „ „ for feeding purposes 30
    Formation of prussic acid from linseed cake 228, 446, 657
  Maize, varieties for forage purposes (*Essex*) 136
  Manurial value of foods (*Leeds*) 318
  Milling offals, feeding value (*Germany*) 579
  Physiological effects of rations drawn from restricted sources (*U.S.*) 563
  Pigs, probable error in pig feeding trials (*Camb.*) 674
    Protein nutrition of (*U.S.*) 577
    Rations for 265
  Potato haulm (*Germany*) 677
  Root feeding, heavy, effect on yield and composition of milk (*Edin.*) 404
  Roots, manurial value of (*Aberdeen*) 320
  Sawdust, feeding value (*Germany*) 580
  Sheep, rations for 199
  Soy beans:
    Cake for dairy cows (*France*) 230
    Cultivation in Britain 33
    Meal for pigs (*Germany*) 321
  Spurrey as a forage crop on sandy soils 214
  Sugar beets, leaves and tops 664
  Sunflower seed cultivation in Russia 591
  Weed seeds (*Germany*) 676
  Wheat, amount of protein in flour, bran and shorts (*U.S*)... ... 322
  Wheat offals (*Germany*) 579, 675
  Whins 670
Flowers (see also under specific name), production in Great Britain ... 399
Forestry:
  Chestnut bark disease in the United States 848
  Congress at Paris, 1913 960
  Deep planting of forest trees on sandy soils (*Germany*) 409
  Development Commissioners, report 1911-12... 779
  Drought of 1911, effect on forest trees... 408
  Experimental forestry in Wales (*Bangor*) 941
  Fence posts, increasing the durability (*U.S.*) 858
  Forest survey, methods of collecting and utilising information for (*Supplement to the Journal*) 411
  Forty years' management of woods 857

Forestry—*continued.* PAGE
- Grant from Development Fund in respect of provision of technical advice in forestry ... 1
- Inverliever Estate, progress of afforestation on ... 305
- Japanese larch, effect of drought on ... 407
- Kerry Woods, notes on (*Journal Supplement*) ... 411
- Soils, mineral substances in forest soils (*Germany*) ... 228
- Spruce, protection of young spruce from frost ... 943
- Squirrels, damage to woods ... 36
- Technical advice in foresty, provision for, from Development Fund 850
- Timber production in Great Britain ... 567
- *Norway*, forestry budget ... 871
- *Saxony*, yield of State forests in 1910... 697

Fowls, see *Poultry.*

France:
- Agicultural credit banks in 1911 ... 1036
- Budget of French Ministry of Agriculture for 1912 ... 416
- Cost of harvesting ... 961
- Farm schools ... 1014
- Importation of Canadian cattle at Calais ... 503
- Paris, exhibition of horses and donkeys, 1912 ... 235
- ,, forestry congress, 1913 ... 960
- Rheims, international congress of electroculture, 1912 ... 501

Fream memorial prize ... 325

Frost, prevention of damage in orchards (*U.S.*) ... 323
- Protection of young spruce from frost... 943

Fruit (see also *Crops*, *Insects*, *Fungi*, *Spraying* and *Import Regulations*):
- Apples:
  - Cider sickness (*Nat. F. & C. Inst.*) ... 54
  - Experiments on growth (*Worcs.*) ... 861
- Frost, prevention of damage from (*U.S.*) ... 323
- Plums, self sterility and self fertility (*John Innes Hort. Inst.*) ... 53
- Pollination of hardy fruits ... 55
- Production of fruit in Great Britain ... 399
- Thirty years' record of a grass orchard in Kent ... 541

Fungi (see also *Spraying*):
- American gooseberry mildew (*Sphærotheca Mors-uvae*) 153, 697, 873, 994
- Black scab of potatoes (*Synchitrium endobioticum*) see *Wart Disease*
- Cabbage top in swedes (*Leeds*) ... 58
- Chestnut bark disease (*Diaporthe parasitica*) ... 848
- Clover sickness (*Sclerotinia trifoliorum*) ... 928
- Finger-and-toe (*Armstrong*) ... 491
- ,, ,, (*U.S.*) ... 668
- Flax rust (*Melampsora lini*)) ... 33
- ,, wilt (*Fusarium lini*) ... 33
- Hop mould... 300
- Loganberry, diseases of canes ... 124
- Potato disease (*phytophthora infestans*) ... 327
  - Minimising the loss caused by ... 441
- Raspberry, diseases of canes ... 124
- Root tumour of hops ... 300
- Rust in wheat (*Puccinia glumarum*) ... 372
- Streak disease of sweet peas (*Thielavia basicola*) ... 57
- "Take-all" of wheat and oats ... 1020
- Wart disease of potatoes (*Synchitrium endobioticum*) ... 56, 62, 327
- Wet rot of potatoes (*Germany*)... 137
- "White-heads" of wheat and oats ... 1020
- *Ascochyta pallor* ... 125
- *Diaporthe parasitica* ... 848
- *Fusarium lini* ... 33
- *Hendersonia rubi* ... 125
- *Melampsora lini* ... 33
- *Ophiobolus graminis* ... 1020
- *Phytophthora infestans* ... 327, 441
- *Plasmodiophora brassicæ* ... 491, 668
- *Puccinia glumarum* ... 372
- *Sclerotinia trifoliorum* ... 928
- *Sphaerotheca Mors-uvae* ... 153, 873

Fungi—*continued.* PAGE
  Synchitrium endobioticum ... 56, 62, 327
  Thielavia basicola ... 57
Furze as a forage crop ... 670

Geological Survey, memoir of ... 233
Germany:
  Agricultural co-operation in ... 312
  Animal diseases, prevalence in 1911 ... 871
  Farm schools ... 1014
  Live stock census, 1912 ... 1055
  ,, ,, ,, in Prussia, 1911 ... 788
  Measures against tuberculosis of cattle ... 65
  Plant breeding in ... 239
  Yield of State forests in Saxony in 1910 ... 697
Ghent, international agricultural exhibition in 1913 ... 782
  Admission of articles for ... 587
  Tenth international congress of agriculture ... 501, 955
Glasshouse soils, treatment for sickness in ... 757, 809
Golding, John: Yellow discoloration of Stilton cheese ... 177
Gooseberry mildew, see *Fungi.*
Gorse as a forage crop ... 670
Grain, see *Corn.*
Grass, see *Pasture.*
Greece, agricultural activity in ... 589
Grouse disease ... 371

Hague international agricultural exhibition in 1913 ... 783
Hailstorms, insurance against damage to crops by ... 1009
Hanley, J. A.: A case of soil infertility due to bad texture and lack of lime ... 375
Harvest weather forecasts ... 233
Harvesting, cost of, in France ... 961
Hay (see also *Pasture, Crops*):
  Ether extracts of hays, composition and digestibility (*U.S.*) ... 856
  Manuring of meadow hay (*Armstrong*) ... 855
  ,, ,, ,, (*Cirencester*) ... 570
  ,, ,, ,, (*Cockle Park*) ... 571
  ,, ,, ,, (*Ireland*) ... 403
  ,, ,, ,, (*Kineton, Warwickshire*) ... 673
  ,, ,, ,, (*Leeds*) ... 571
  ,, ,, ,, (*Wilts*) ... 317
  Packing with hay and straw, notice as to ... 1039
  Produce in 1912 ... 700, 874
Hedge-cutting and laying ... 546
Hedge End agricultural credit society ... 37
Holdings (see also *Small Holdings*):
  Agricultural Holdings Act, 1913 ... 1028
  Changes in the number and size of agricultural holdings ... 1049
Holland:
  American gooseberry mildew, measures for combating ... 697
  Beet sugar industry ... 502
  Control of plant diseases in ... 235
  Hague international agricultural exhibition, 1913 ... 783
  Live stock industry ... 590
  Oats, increase in productivity ... 236
  Phytopathological service for the exportation of plants ... 417
  Proposed legislation to enable agricultural labourers to acquire or rent land ... 692
"Home Counties": The production of clean milk on two large dairy farms ... 923
Hooper, C. H.: The thirty years' record of a grass orchard ... 541
Hops (see also *Crops*):
  Acreage in 1912 ... 594
  Fibre of hop vine as possible substitute for hemp ... 237
  Hop growing on the Pacific coast of America 89, 187, 293, 378, 1047
  Picking machine ... 379

Hops—*continued.* PAGE
Produce in 1912 ... 699
Italy ... 592
Horses, see *Live Stock*
Horticultural branch of the Board of Agriculture and Fisheries, vacancy for a general inspector ... 777
House flies ... 374
Hungary, see *Austria-Hungary.*
Hutchinson, H. P. : Tor-grass or false brome, and its eradication from down pastures ... 648
Hydrocyanic acid, formation from linseed cake ... 228, 446, 657
Import and Export Regulations :
Africa, German South-West, cattle, &c. from Europe ... 65
Algeria, potatoes affected with wart disease ... 65
Argentina, lucerne and forage plant seed ... 958
Potatoes ... 1051
Australia, cattle ... 958
Hay and straw ... 871
Live stock ... 587
Plants ... 1050
Belgium, sheep and goats ... 500
British Columbia, cattle ... 1051
Canada, potatoes ... 696
Cape Colony, importation and sale of fertilisers ... 412
East Africa Protectorate, animals ... 696
England, landing of Irish store cattle ... 581
Falkland Islands, live stock ... 696
France, hay, straw and manure ... 696
Transit of animals ... 501
Gold Coast, plants ... 235
Great Britain, animals from Great Britain into other countries ... 412
Holland, gooseberry, black, red and white currant and raspberry bushes ... 697
Plants ... 235
Ireland, currant and gooseberry bushes ... 873
Prohibition of animals from Great Britain ... 324
Isle of Man, hay, straw, and peatmoss ... 1050
Italy, plants in transit ... 871
Jersey, potatoes ... 500
New Zealand, live stock ... 697
Nyasaland, plants ... 1051
Roumania, hides and skins ... 412
Sierra Leone, plants ... 234
Southern Rhodesia, potatoes ... 781
South Africa, live stock ... 587, 783, 871, 1050
Potatoes ... 411
Straits Settlements, animals ... 958
Sudan, dogs ... 1051
Sweden, animals ... 696, 1051
Feeding stuffs ... 587
United States, grain and seeds ... 586
Nursery stock ... 780
Pedigree stock for breeding ... 234
Potatoes ... 781
Removal of restrictions on animals from Great Britain ... 64
Uruguay, plants, seeds and manures ... 695
Western Australia, fruit ... 871
Imports :
Agricultural produce ... 499, 838
Grain in the cereal year 1911–12 ... 476
Incubation, see *Poultry.*
India, co-operative credit in ... 947
Insects (see also *Bees* and *Spraying*) :
Allied green mangold aphis (*Rhopalosiphum betæ*) ... 918
Anthonomus of the raspberry and strawberry (*Anthonomus rubi*) 394
Aphides on mangolds and allied plants ... 466, 914
Bean aphis (*Aphis rumicis*) ... 467
Black aphis (*Aphis rumicis*) ... 467

Insects—*continued.* PAGE
  Black blight (*Aphis rumicis*) ... 467
  Black currant mite, measures for combating in Ireland ... 873
  Boat gall (*Aphis atriplicis*) ... 914
  Cabbage top in swedes due to swede midge ... 58
  Clover sickness (*Tylenchus devastatrix*) ... 928
  Collier (*Aphis rumicis*) ... 467
  Fritfly, damage to oats ... 482, 1046
  Green mangold aphis (*Aphis atriplicis*) ... 914
  Hop aphis ... 296
  Hop flea beetles ... 298, 753
  Mangold aphis (*Aphis rumicis*) ... 467
  Pea moth (*Endopisa nigricana*) ... 27
  Poplar leaf beetles ... 554
  Poppy aphis (*Aphis rumicis*) ... 467
  Red spider ... 300
  Short-siphoned mangold aphis (*Aphis brevisiphona*) ... 919
  Swede midge (*Contarinia nasturtii*) ... 59
  Teasel aphis (*Aphis ochropus*) ... 920
  Turnip fly (*Essex*) ... 138
  Willow leaf beetles ... 554
  Anthonomus rubi ... 394
  Aphis atriplicis ... 914
    „ *brevisiphona* ... 919
    „ *ochropus* ... 920
    „ *rumicis* ... 467
  Contarinia nasturtii ... 59
  Endopisa nigricana ... 27
  Galerucella lineola ... 554
    „ *tenella* ... 557
    „ *viburni* ... 557
  Melasoma populi ... 559
    „ *longicolle* ... 559
  Phyllodecta (*Phratora*) *cavifrons* ... 558
    „ *vitellinæ* ... 557
    „ *vulgatissima* ... 558
  Plectroscelis concinna ... 298
  Psylliodes attenuata ... 298
    „ *punctulata* ... 298, 753
  Rhopalosiphum betæ ... 918
  Tylenchus devastatrix ... 928
Insurance against damage to crops by hailstorms ... 1009
  Co-operative insurance, see *Co-operation and Credit.*
Intelligence division of Board of Agriculture and Fisheries, report, 1911 (Part I.) ... 234
International Institute of Agriculture (for report on Crop Prospects see summary in each issue):
  Year book of agricultural legislation ... 776
  Year book of agricultural statistics ... 598
Inverliever Estate, progress of afforestation on ... 305
Ireland, agricultural output in 1908 ... 754
  Measures for combating American gooseberry mildew and black currant mite ... 873
Isle of Wight Bee Disease (see also Journal Supplement, No. 8, May, 1912) ... 133
Italy, hop growing for breweries ... 592
  Meat trade ... 502
  Premiums for construction of farm buildings ... 504

Japan, demand for manures ... 415
Japanese larch, effect of drought on ... 407

Kemerton and Overbury pig club ... 209

Labour:
  Sweden, statistics of agricultural labour ... 588
  United States, agricultural labour in ... 853
Larks, food of (*Camb.*) ... 496

PAGE
Lavender cultivation ... 939
Leaflets of the Board of Agriculture and Fisheries ... 952
Legislation, agricultural, year book of International Agricultural Institute ... 776
Lime, influence on fertility of soils ... 375
Lime-sulphur wash, see *Spraying*.
Linseed, growth of (*Bangor*) ... 135
,, ,, (*Essex*) ... 223
,, ,, for feeding purposes ... 30
  Formation of prussic acid from linseed cake... 228, 446, 657
Live stock (see also *Co-operation and Credit*, *Diseases of Animals*, *Feeding Stuffs* and *Import Regulations*) :
  Cattle :
    Clubs, see *Co-operation and Credit*.
    Feeding, see *Feeding Stuffs*.
    Shorthorn calves, weight at birth (*Cirencester*)... 939
    Slaughter of young calves ... 3, 617
    Store cattle, supply of ... 3, 617
  Dairy cows, see *Dairying*
  Feeding of stock, see *Feeding Stuffs*.
  Horses :
    Advisory council on horse-breeding, report of meeting, June, 1912 ... 325
    Feeding, see *Feeding Stuffs*.
    Horse-breeding, preliminary grant for ... 392
    King's premium stallions, names and routes ... 142
    Paris exhibition of horses and donkeys, 1912 ... 235
    Ponies, improvement of mountain and moorland breeds ... 955
    Stallions, thoroughbred, show, 1912 ... 62, 142
    ,, ,, ,, 1913 ... 775
  Insurance, see *Co-operation and Credit*.
  Landing of Animals from Ireland Order of 1913 ... 1040
  Metabolic water, its production and *rôle* in vital phenomena (*U.S.*) 495
  Panama-Pacific international exhibition of live stock, 1915 ... 501
  Pigs :
    Clubs, see *Co-operation and Credit*.
    Feeding, see *Feeding Stuffs*.
    Probable error in pig-feeding trials (*Camb.*) ... 674
    Protein nutrition of the pig (*U.S.*) ... 577
  Sheep :
    Breeding experiments with Welsh mountain ewes (*Bangor*) 939
    Crossing experiments (*Leeds*) ... 576
    Feeding, see *Feeding Stuffs*.
    Origin of domestic sheep ... 364
    Production of lambs in autumn and winter (*U.S.*) ... 565
  Store cattle, supply of ... 3, 617
  Argentina, live stock census, 1910 ... 248
  Austria, organisation of sale of live stock ... 691
  Belgium, encouragement of horse breeding ... 502
  France, importation of Canadian cattle ... 503
  Germany, live stock census, 1912 ... 1055
  Great Britain, number of live stock, 1912 ... 505, 1047
  Holland, live stock industry ... 590
  Hungary, live stock census, 1911 ... 70
  ,, ,, ,, 1912 ... 1055
    Croatia and Slavonia, live stock census, 1911 ... 157
  Luxemburg, live stock census, 1910 ... 331
  Prussia, live stock census, 1911 ... 788
  Scotland, number of live stock, 1912 ... 786
  South Africa, free carriage of pedigree live stock to ... 783
  United States, live stock census, 1913... 1055
  Uruguay, state grants to live stock shows ... 588
Long, H. C. : The identification and eradication of some common weeds-iv. 273
Long, J. : The control of agricultural seeds in Switzerland ... 726
Lucerne, experiments (*U.S.*) ... 576
  Growth of (*Bangor*) ... 51
  Soil inoculation for (*U.S.*) ... 317
Luxemburg, live stock census, 1910 ... 331

PAGE

MacDougall, R. Stewart: The pea moth ... 27
    Willow and poplar leaf beetles ... 554
Machinery:
    Milking machines, tests of (*France*) ... 139
    Algeria ... 64
    Portuguese East Africa ... 414
    Russia ... 413
    Siberia ... 593
    Uruguay ... 65
    West Australia, state manufacture of agricultural implements ... 414
Maize, varieties of, for forage purposes (*Essex*) ... 136
Mangolds:
    Manuring (*Bangor*) ... 225, 937
    ,, (*Devon*)... 318
    ,, (*Essex*) ... 224
    ,, (*Wilts*) ... 317
Mansell, Alfred: Supply of store and dairy cattle ... 3
Manual instruction in rural elementary schools ... 957
Manures (see also *Special crops*):
    Basic slag, purchase and use ... 660
    "Biphosphate"—new Norwegian artificial manure ... 238
    Cake, manurial value of (*Norfolk*) ... 60
    Calcium cyanamide, necessity for precaution in storing ... 308
    Catalytic manures, experiments with (*France*) ... 227
        Manganese (*Germany*) ... 320
        Sulphur (*France* and *Germany*) ... 320
        ,, (*France*) ... 573
    Farmyard manure, chemical composition as a measure of its value (*Leeds*)... 318
    Foods, manurial value (*Leeds*) ... 318
    Lime, influence on fertility of soils ... 375
    Liming, some bacteriological effects of (*U.S.*) ... 573
    Manganese (*Germany*) ... 320
    Peat moss litter manure (*Sweden*) ... 856
    Phosphate, rock, factors influencing availability (*U.S.*) ... 402
    Potash, production from kelp or seaweed (*U.S.*) ... 235
    Residuary effects of manures employed in the experiments on grass land at Sevington ... 52
    Roots, manurial value (*Aberdeen*) ... 320
    Sawdust, effect on plants (*U.S.*) ... 226
    Seaweed ... 503
    Sulphate of ammonia, production in 1911 ... 585
    Sulphur (*France* and *Germany*) ... 320
    ,, (*France*) ... 573
    Cape Colony, importation and sale of fertilisers ... 412
    Chile, nitrate production ... 593
    Japan, demand for manures in... 415
    Russia ... 414
    Spain, consumption of artificial manures ... 415
Market prices, weekly return of ... 955
Marram grass for paper-making ... 935
Martin, E. A.: Ponds in agricultural districts ... 17
Massee, George: The presence of tubers on potato haulms ... 560
Meat (see also *Live stock*).
    Italy, meat trade ... 502
    United States, meat supplies at Chicago ... 965
Mendelism:
    Breeding experiments with Welsh mountain ewes (*Bangor*) ... 939
    Inheritance of disease resistance in plants ... 372
    Potatoes, inheritance of distinct characters ... 364, 574
    Sheep crossing experiments (*Leeds*) ... 576
    Wheat, inheritance of disease resistance ... 372
    East Africa Protectorate, wheat breeding in ... 1052
Metabolic water, its production and *rôle* in vital phenomena (*U.S.*) ... 495
Meteorology, see *Weather*.
Milk, see *Dairying*.
Moss, eradication from permanent pastures (*Cornwall*) ... 673

PAGE

New Zealand:
  Agricultural exhibition at Auckland, 1913-14 782
Norway:
  Dairy industry 592
  Forestry budget 871
  New artificial manure 238
  Seaweed, treatment for commercial purposes 503
Oats (see also *Crops*):
  Change in composition of oat plant as it approaches maturity (*U.S.*) 488
  Effect of competition on elimination of plants (*U.S.*) 574
  Fritfly, damage to oats by 482, 1046
  Varieties (*Aberdeen*) 51
    ,, (*Bangor*) 51
    ,, (*Chelmsford*) 314, 1031
    ,, (*East Suffolk*) 1031
  Holland, increase in productivity of 236
Okey, Thomas: Preparation of willows for market 277
Oldershaw, A. W.: Hedge-cutting and laying 546
Ordnance maps, reproduction of 870
Osiers, see *Willows*.
Overbury pig club 209

Panama-Pacific international exhibition, 1915 501
Pansies, cultivation by allotment holders 749
Paper-making, marram grass for 935
Paris, forestry congress, 1913 960
Paynter, F. G.: Poultry experiments by 721, 902
Pasture (see also *Clover*, *Lucerne* and *Crops*):
  Causes of the high nutritive value and fertility of the fattening pastures of Romney and other Marshes (*Rothamsted*) 315
  Germination of grass seeds 731, 930
  Improvement of poor hill pasture 353
  Manures, effect on herbage of grass land (*Cirencester*) 936
  Manuring of meadow hay (*Armstrong*) 855
    ,, ,, ,, (*Cirencester*) 570
    ,, ,, ,, (*Cockle Park*) 571
    ,, ,, ,, (*Ireland*) 403
    ,, ,, ,, (*Kineton, Warwickshire*)... 673
    ,, ,, ,, (*Leeds*) 571
    ,, ,, ,, (*Wilts*) 317
  Manuring of permanent pasture (*Cockle Park*) 671
  Mixtures of grass seeds (*Bangor*) 51, 938
  Moss, eradication from pastures (*Cornwall*) 673
  Purity of grass seeds 731, 930
  Residuary effects of manures employed in the experiments on grass land at Sevington 52
  Top dressing pastures (*H. & Agric. Soc.*) 227
Pears, see *Fruit*.
Peat moss litter manure (*Sweden*) 856
Petherbridge, F. R.: Partial sterilisation of soil for glasshouse work ... 809
Pigeons, destruction of wood pigeons 954
Pigs, see *Live stock*.
Pigsties, construction 289
Plant breeding:
  Hereditary characters in the potato 364, 574
  Inheritance of disease resistance in plants 372
  East Africa Protectorate, wheat breeding in 1052
  Germany 239
Plant diseases (see also *Insects* and *Fungi*):
  Disease resistance in plants 372
  Measures for combating American gooseberry mildew and black currant mite in Ireland 873
  Holland, control of plant diseases in 235
    Phytopathological service for the exportation of plants ... 417
Plant nutrition 368
Plums see *Fruit*.

PAGE

Pollination, see *Fruit.*
Ponds in agricultural districts ... 17
  Destruction of weeds in ponds ... 216
Population of agricultural districts ... 396
Potatoes (see also *Fungi*, *Insects*, *Import Regulations* and *Crops*):
  "Bruise" in potatoes (*Wisley*)... 492
  Change of seed (*Chelmsford*) ... 313, 1030
  Harvest in Lincolnshire and Cambridgeshire in 1912 ... 698
  Haulm, feeding value (*Germany*) ... 677
  Inheritance of distinct characters ... 364, 574
  Manuring (*Bangor*) ... 226
    ,, (*Devon*)... 318
    ,, (*Ireland*) ... 489
    ,, (*Wilts*) ... 317
  Size of seed (*Chelmsford*) ... 1030
  Spraying (*Bangor*) ... 58
    Copper fungicides, absorption of ... 751
  Sprouting potatoes for use as seed (*Ireland*) ... 575
  Tubers on potato haulms ... 560
  Varieties (*Bangor*) ... 51
    ,, (*Chelmsford*) ... 313, 1030
  Wart disease, Order of 1912 ... 62
    Warning as to ... 367
  Weather, influence of (*Germany*) ... 223
  Argentina ... 502
  United States, cost of producing ... 328
Poultry: Autumn and spring chicken rearing (*U.S.*) ... 494
  Chicken rearing on an intensive system ... 721, 902
  Digestion experiments (*U.S.*) ... 859
  Egg, improvement of (*U.S.*) ... 494
  Egg-laying competitions (*Australia*) ... 860
  Egg production of hens at different ages (*U.S.*) ... 492
  Experiments with (*Australia*) ... 860
    ,, ,, (*U.S.*) ... 1033
  Fattening (*U.S.*) ... 493
    ,, chickens (*Canada*) ... 494
  Houses (*Canada*) ... 494
  Incubation, artificial, experimental work in ... 909
  Laying competition of Utility Poultry Club, 1912-13 ... 500, 1052
  Production in Great Britain ... 308
  Tuberculosis (*Canada*) ... 494
  Europe, poultry farming in ... 241
Prague, agricultural exhibition, 1913 ... 1052
Prees Cottagers' Cow Club ... 388, 1035
Prices:
  Market prices, weekly return of ... 955
  Prices of agricultural produce ... 410
Pruning, see *Fruit.*
Prussic Acid, see *Hydrocyanic Acid.*
Pulse crops, produce in 1912 ... 700, 874

Research:
  Report on grants for agricultural research, 1911-12 ... 1016
  Research scholarships in agricultural science, awards ... 499
  Scheme for agricultural research and technical advice for farmers 1025
  Special research grants ... 1046
Ross, J.: System of cattle feeding ... 835
Rural Education Conference:
  Courses in agricultural colleges... 126
  Manual instruction in rural elementary schools ... 957
Russell, E. J.: Partial sterilisation of soil for glass-house work... 809
Russia:
  Agricultural machinery ... 413, 593
  Artificial manures in ... 414
  Khabarovsk exhibition, 1913 ... 413
  Rostov-on-Don exhibition, 1912 ... 413

Russia—*continued.* PAGE
St. Petersburg international horticultural exhibition ... 587, 961
Sunflower seed cultivation ... 591
Zemstvo credit banks ... 950

St. Petersburg, international horticultural exhibition ... 587, 961
Salmon, E. S.: The lime-sulphur wash for use on gooseberries ... 99
Lime-sulphur wash for American gooseberry mildew ... 994
Sawdust, effect on plants (*U.S.*) ... 226
Feeding value (*Germany*) ... 580
Scotland:
Area under crops and number of live stock, 1912 ... 785
Produce of corn, pulse and hay crops in 1912 ... 874
" " potato and root crops in 1912 ... 875
Seaweed as a source of potash ... 235
Treatment for commercial purposes in Norway ... 503
Seeds (see also *Weeds*):
Analyses, their interpretation and use ... 827
Analyses of various samples of agricultural seeds ... 530, 731, 930
Application of different names to same variety of seed ... 398
Light, influence on germination (*Germany*) ... 231
Longevity (*Kew*) ... 231
Mixtures of grass and clover seeds (*Bangor*) ... 51, 938
Quality of farm seeds ... 530, 731, 930
Respiration of germinating seeds, influence of electricity on (*Brit. Assoc.*) ... 140
Ripeness, effect on germinating capacity (*Denmark*) ... 231
Study of agricultural seeds ... 529
Temperature, influence on germination (*Germany*) ... 231
Vitality of farm seeds (*R.A.S.E.*) ... 141
Water content, effect on germinating capacity (*Denmark*) ... 231
Weeds present in seedsmen's samples ... 529
Weed seeds, composition and feeding value (*Germany*) ... 676
Russia, sunflower seed cultivation ... 591
Switzerland, control of agricultural seeds ... 726
Sheep, see *Live Stock.*
Shows, see *Exhibitions.*
Shropshire, survey of the soils and agriculture ... 936
Small Holdings:
Administration of the Small Holdings Act in 1911 ... 220
Agricultural Holdings Act, 1913 ... 1028
Buildings for small holdings, duration of ... 1047
Changes in the number and size of agricultural holdings ... 1049
Condition of small holdings in 1911 ... 222
Loans for the equipment and adaptation of ... 694
Pansies, cultivation by allotment holders ... 749
Proceedings under the Small Holdings and Allotments Acts in 1911, report ... 234
Societies for provision and maintenance ... 49, 584
Violas, cultivation by allotment holders ... 749
Whissonsett small holders' credit society ... 773
Holland, proposed legislation to enable agricultural labourers to acquire or rent land ... 692
Soil bacteriology:
Inoculation of red clover (*Devon*) ... 228
Soils:
Analysis, practical value of ... 479
Forest soils, mineral substances in ... 228
Infertility due to bad texture and lack of lime ... 375
Soil solution and the nutrition of plants ... 368
Sterilisation, partial, for glasshouse work ... 757, 809
Weeds in relation to ... 20
South Africa, agriculture in ... 240
Agricultural expansion in ... 416
Importation and sale of fertilisers in Cape Colony ... 412
Pedigree live stock, free carriage to ... 783, 1050
Soy beans, see *Feeding Stuffs.*

PAGE

- Spain, artificial manures in ... 415
- Sparrows, food of nestlings ... 463
- Spraying:
  - Bordeaux mixture, physiological and fungicidal effects (*Germany*) 762
    - Some factors influencing efficiency (*U.S.*) ... 1034
  - Copper fungicides, absorption by potatoes ... 751
  - Lime-sulphur wash for use on gooseberries ... 99, 994
  - Nicotine as an insecticide (*U.S.*) ... 491
  - Potato spraying (*Bangor*) ... 58
    - Absorption of copper fungicide by potatoes ... 751
  - Tobacco cultivation for the preparation of fruit and hop washes ... 985
  - Tobacco extracts as insecticides (*U.S.*) ... 491
  - Tobacco, growth of, for nicotine extraction (*Wye*) ... 486
    - Regulations as to growth for nicotine extraction ... 1040
  - Turnips, spraying for turnip fly (*Essex*) ... 138
- Spruce, protection of young spruce from frost ... 943
- Spurrey as a forage crop on sandy soils ... 214
- Squirrels, damage to woods ... 36
- Starlings, food of nestlings ... 461
- ,, ,, ,, (*Camb.*) ... 496
- Statistics (see also *Agricultural Returns*):
  - Application of statistical methods to the interpretation of experimental results ... 367
  - Year book of agricultural statistics of the International Institute of Agriculture ... 598
- Strawberries, see *Fruit.*
- Sugar Beet (see also *Crops*).
  - Cultivation (*Bangor*) ... 938
  - ,, (*Devon*) ... 315
  - ,, (*Wilts*) ... 315
  - Feeding to live stock ... 664
  - Investigations on ... 488
  - Leaves and tops, feeding to live stock ... 667
  - Report on experiments (*Board of Agriculture and Fisheries*) ... 134, 152
  - Weather, influence on (*Germany*) ... 223
  - *Holland*, sugar beet industry ... 502
- Supplements to the Journal:
  - Isle of Wight bee disease ... 133
  - Methods of collecting and utilising information for a forest survey 411
- Sunflower seed cultivation in Russia ... 591
- Sweden:
  - Agricultural labour, statistics of ... 588
  - Budget of Ministry of Agriculture for 1913 ... 243
- Swedes (see also *Crops*):
  - Manuring (*Devon*) ... 318
  - ,, (*West of Scotland*) ... 759
- Swine, see *Live Stock.*
- Switzerland: Control of agricultural seeds ... 726

- Tarring of roads, effect on plants (*France*) ... 859
- Teasel, cultivation ... 738
- Thatching of ricks ... 300
- Theobald, F. V.: The aphides on mangolds and allied plants ... 466, 914
- Thrush, food of nestlings ... 463
- Timber, see *Forestry.*
- Tithe, &c., Acts, report of proceedings of Board under, in 1911 ... 153
- Tobacco, British-grown ... 904
  - Cultivation for the preparation of fruit and hop washes ... 985
  - Extracts as insecticides (*U.S.*) ... 491
  - Growth of, for nicotine extraction (*Wye*) ... 486
  - Regulations as to growth for nicotine extraction ... 1040
- Tomatoes, sterilisation of tomato-sick soils ... 817
- Tor-grass, see *Weeds.*
- Transvaal, agriculture in ... 240
- Tuberculosis, see *Diseases of Animals.*

PAGE

Turnips (see also *Crops*) :
  Manurial value (*Aberdeen*) ... 320
  Manuring (*Aberdeen*) ... 53
  „ (*West of Scotland*) ... 759

United States :
  Agricultural labour in ... 853
  Chestnut bark disease ... 848
  Cost of producing barley and potatoes ... 238
  Hop growing in Oregon, Washington and California 89, 187, 294, 378, 1047
  Live stock census, 1913 ... 1055
  Meat supplies at Chicago ... 965
  Promotion of agriculture by private effort ... 1052
Unstead, J. F. : Climatic limits of wheat cultivation ... 742
Uruguay, agricultural experiment stations in ... 244
  Agricultural machinery in ... 65
  State grants to live stock shows ... 588
Utility Poultry Club, laying competition, 1912-13 ... 500, 1032

Vegetables (see also *Potatoes, &c.*) :
  Experiments on growth (*Worcs.*) ... 861
Venezuela, market for tinned butter ... 416
Veterinary officers, departmental committee on employment of ... 498
  Report of committee ... 931
Vienna, Adriatic exhibition, 1913 ... 960
Vines, partial sterilisation of vine-sick soils ... 823
Violas, cultivation by allotment holders ... 749

Wages, see *Labour.*
Wart (disease of potatoes order of 1912) ... 62
  Warning as to ... 327
Water, metabolic, production and rôle in vital phenomena (*U.S.*) ... 495
Weather forecasts during harvest, by Meteorological Office ... 233
  Frosts, prevention of damage in orchards (*U.S.*) ... 323
  Hailstorms, insurance against damage to crops by ... 1009
  Influence of weather on barley, potatoes and sugar beet (*Germany*) 223
  Relation of weather to agriculture ... 366
Weeds (see also *Seeds*) :
  Cleavers, eradication (*Germany*) ... 321
  Dodder, germinating capacity of seeds (*Germany*) ... 762
  False brome and its eradication from Down pastures ... 648
  Flax dodder (*Cuscuta Epilinum*) ... 33
  Horsetail (*Equisetum arvense*) as a cause of horse poisoning ... 229
  Identification and eradication of some common weeds ... 273
  Meadow saffron (*Colchicum autumnale*) destruction of ... 852
  Relation to soils ... 20
  Runch, destruction of, by sulphuric acid (*France*) ... 137
  Seeds of weeds, composition and feeding value (*Germany*) ... 676
  Shepherd's needle ... 275
  Sorrel ("sour-dock"), effect of lime on (*Leeds*) ... 858
  Spurrey as a forage crop on sandy soils ... 214
  Tor-grass and its eradication from Down pastures ... 648
  Water weeds, destruction of ... 216
  Weeds present in seedmen's samples ... 529
  Wild carrot ... 273
  Wild onion eradication (*R.A.S.E.*) ... 136
  Wild Radish, eradication from serradella ... 1034
  Yellow rattle as a weed on arable land ... 1005
  Allium vineale ... 136
  Brachypodium pinnatum ... 648
  „ *sylvaticum* ... 648
  Colchicum autumnale ... 852
  Cuscuta Epilinum ... 33

Weeds—*continued,* PAGE

- *Cuscuta Trifolii* ... 762
- ,, *suaveolens* ... 762
- *Daucus Carota* ... 273
- *Equisetum arvense* ... 229
- *Galium Aparine* ... 321
- *Raphanus Raphanistrum* ... 137, 1034
- *Rhinanthus Crista-galli* ... 1005
- *Rumex Acetosa* ... 858
- *Scandix Pecten-Veneris* ... 275
- *Spergula arvensis* ... 214

Welland High Bridge Pig Club, Spalding ... 1036
Wem Cow Club ... 946
Western Australia, State manufacture of agricultural implements in ... 414
Wheat (see also *Crops*):

- Cultivation, climatic limits of ... 742
- Disease resistance in, inheritance of ... 372
- Effect of competition on elimination of plants (*U.S.*) ... 574
- Manuring (*Wilts*) ... 317
- Nitrogen of wheat, distribution between flour, bran and shorts (*U.S.*) ... 322
- Offals ... 308
    - Feeding value (*Germany*) ... 579, 677
- Quality in ... 362
- Varieties, new ... 37
    - ,, (*Chelmsford*) ... 314, 758, 1029
    - ,, (*East Suffolk*) ... 572
    - ,, (*Ireland*) ... 486, 753
    - ,, (*Norfolk*) ... 938
- *East Africa Protectorate*, analysis of sample of wheat from .. 1055

Whins as a forage crop ... 670
Whissonsett small holders' credit society ... 773
Willows:

- Cricket bat willow, experiments (*Kew*) ... 321
- Manurial requirements (*Belgium*) ... 53
- Preparation for market ... 277

Wolff, H. W.: Spurrey as a forage crop on sandy soils ... 214
Wood pigeons, destruction of ... 954
Woods, see *Forestry.*
Wright, C. W. B.: Lime-sulphur wash for American gooseberry mildew 994

Yearbook of agricultural legislation of International Agricultural Institute ... 776
Yearbook of agricultural statistics of International Agricultural Institute ... 598

Zürich seed control station ... 726

Supplement
TO
The Journal
OF THE
BOARD OF AGRICULTURE

VOL. XIX. No. 2. MAY, 1912.

REPORT
ON THE
ISLE OF WIGHT BEE DISEASE
(*Microsporidiosis*)

G. S. GRAHAM-SMITH, M.D.
H. B. FANTHAM, D.Sc., B.A., F.Z.S.
ANNIE PORTER, D.Sc., F.L.S.
G. W. BULLAMORE.
W. MALDEN, M.D.

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE
BY R. CLAY & SONS, LTD., BRUNSWICK STREET, STAMFORD STREET, LONDON, S.E.,
AND PUBLISHED BY THE BOARD OF AGRICULTURE AND FISHERIES.

SUPPLEMENTS TO THE JOURNAL OF THE BOARD OF AGRICULTURE.

No. 1.—Report on Agricultural Education in the United States	Jan., 1908
No. 2.—The Food of Some British Birds	Dec., 1908
No. 3.—Reports on the Work of the International Agricultural Institute	April, 1910
No. 4.—Wheat: Papers Read at a Meeting of the British Association at Winnipeg, 1909	June, 1910
No. 5.—Influence on the Production of Mutton of Manures Applied to Pasture	Jan., 1911
No. 6.—Report on the Work of the International Agricultural Institute	July, 1911
No. 7.—The Interpretation of the Results of Agricultural Experiments	Nov., 1911
No. 8.—Report on the Isle of Wight Bee Disease	May, 1912

THE present Report on the Epidemic among Bees in Great Britain, prepared by Dr. Graham-Smith and his colleagues, is the third report on the subject which has been published by the Board of Agriculture and Fisheries. The first, prepared by Mr. A. D. Imms, was published in the Journal of the Board of Agriculture for June, 1907. The second, written by Dr. Malden, appeared in the Journal for February, 1909. References to the subject were also made in the Report of the Intelligence Division of the Board of Agriculture and Fisheries, Part II., for the years 1909–10 and 1910–11. Full use has, however, been made of the information collected in these Reports by Dr. Graham-Smith, and the present Report is therefore complete in itself. All known information on the subject of this disease is given in this Report, but as there are many problems as yet unsolved, arrangements have been made by the Board for the inquiry to be continued during 1912–13, and it is hoped that a further Report may be published next year. Bee-keepers willing to assist in this investigation should communicate with the Board, giving full particulars of any abnormal mortality among their bees, and the date when it was first noticed. In no case should bees, either alive or dead, be sent unless asked for, and then only in accordance with directions which will be supplied. Letters should be addressed to The Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W. Letters so addressed need not be stamped, but the words "Bee Disease" should be written across the envelope.

BOARD OF AGRICULTURE AND FISHERIES,
4, WHITEHALL PLACE,
LONDON, S.W.
May, 1912.

CONTENTS

PAGE

SECTION I.—Introduction, by G. S. GRAHAM-SMITH 5

„ II.—The History of the Disease, by G. W. BULLAMORE and W. MALDEN 12

„ III.—Symptoms, by G. W. BULLAMORE and W. MALDEN . 29

„ IV.—The Relation of *Nosema apis* to the Isle of Wight Disease, by G. S. GRAHAM-SMITH, H. B. FANTHAM, and ANNIE PORTER 39

„ V.—The Life-History of *Nosema apis*, and the significance of the various stages of the Parasite in the Disease, by H. B. FANTHAM and ANNIE PORTER . . . 57

„ VI.—Experimental Infection with *Nosema apis*—
  A. Earlier Experiments, by H. B. FANTHAM and ANNIE PORTER 79
  B. Experiments during 1911, by G. S. GRAHAM-SMITH and G. W. BULLAMORE 81

„ VII.—The Ways in which the Disease may be Spread, by G. S. GRAHAM-SMITH and G. W. BULLAMORE . 95

„ VIII.—Some Field Observations on Natural Methods of Infection, by H. B. FANTHAM and ANNIE PORTER . 119

„ IX.—Examinations of certain Insects found in Hives, by H. B. FANTHAM and ANNIE PORTER . . . 123

„ X.—Treatment and Prevention, by G. S. GRAHAM-SMITH and G. W. BULLAMORE 125

„ XI.—Microsporidiosis in other Hymenoptera—
  A. Infection Experiments, by H. B. FANTHAM and ANNIE PORTER 130
  B. Observations on Humble-Bees, by H. B. FANTHAM 131
  C. Infection Experiments and Observations, by G. S. GRAHAM-SMITH 131

„ XII.—Bacteriology of the Disease, by W. MALDEN . . . 133

, XIII.—Note on certain Protozoa found in Bees, by H. B. FANTHAM and ANNIE PORTER 138

BIBLIOGRAPHY 139

REPORT ON THE ISLE OF WIGHT BEE DISEASE (*Microsporidiosis*)

SECTION I.

INTRODUCTION.

By G. S. GRAHAM-SMITH, M.D.

In March, 1911, the Board of Agriculture and Fisheries invited the writer to undertake an investigation into the disease of bees, known as the Isle of Wight disease. The present report gives the results of the investigation, so far as it has been possible to carry it during the last year. Early in 1911 the disease was known to be present in several parts of England, and had been reported from Scotland. No very definite results had been obtained by previous investigators, and numerous hypotheses were current as to the cause of the disease. The great bulk of the evidence obtainable, however, pointed to the disease being of an infectious character, and therefore probably produced by the agency of some bacterial or protozoal parasite.

Dr. Malden had already proved that no bacteria could be demonstrated in the tissues of diseased bees, apart from those present in the alimentary canal. He had investigated many of the species found in the intestines of healthy and diseased bees, and had found that one, which he named *B. pestiformis apis,* was frequently present, though often in small numbers, in the chyle stomachs of diseased bees, but not in those of healthy bees. Infection experiments with cultures of this organism had, however, proved negative, and consequently it could not be regarded as the causal agent of the disease. No other bacterium had been discovered which was constantly present in the intestines of diseased bees and absent from those of normal bees. The balance of evidence was therefore against the disease being due to a bacterial parasite, though, judging by the excessive numbers of bacteria present in the intestines of diseased bees, it seemed probable that bacterial multiplication was a factor of some importance in aggravating the symptoms after the causal agent had established itself in the bees.

Dr. Malden has continued his work on the bacteriology of the disease, and his report on this part of the subject is given in Section XII.

Turning to the protozoal parasites, it was ascertained that Drs. Fantham and Porter, who had been working for some years on this disease with very limited material, had observed that a protozoon, independently discovered by *Zander** (1909) in Bavaria, and named by him *Nosema apis*, was commonly present, often in large numbers, in the intestines of bees, exhibiting the symptoms of the Isle of Wight disease, obtained from different localities, including the island.

It was evidently necessary to follow up this important discovery and to determine whether *Nosema apis* was the cause of the Isle of Wight disease. This problem involved in the first place an investigation into the life-history of *Nosema,* which was undertaken by Drs. Fantham and Porter, whose interesting and important observations are described in Section V.; in the second place, an examination of specimens of bees, combs, &c., from a number of different stocks apparently suffering from the disease, and thirdly, experiments to determine the effects produced by the parasite on healthy bees. The specimens received were examined by the writer and Drs. Fantham and Porter, and the experiments were carried out by the writer and Mr. G. W. Bullamore, and are reported in Sections IV. and VI. respectively.

The Board of Agriculture and Fisheries placed at our disposal their files of correspondence and the reports of their inspectors. From these and from the published reports on the disease, Mr. Bullamore and Dr. Malden have studied the various symptoms which have been recorded, and have summarised them in Section III. They have also studied the records, several of which were sent to us by Mr. T. W. Cowan, relating to the diseases of adult bees published in other parts of the world. The information thus obtained is given in Section II. Sections devoted to the ways in which the disease may be spread (VII.), field observations on natural means of infection (VIII.), the examinations of insects found in hives (IX.), treatment and prevention (X.), observations on other hymenoptera (XI.), and notes on certain protozoa observed in bees (XIII.) are added.

The writer has been most fortunate in securing the co-operation, since the commencement of the inquiry, of the workers mentioned. Dr. Malden's special knowledge of the bacteriology of bees and of the history and symptoms of the disease has proved most valuable, as has also the co-operation of Drs. Fantham and Porter, who had already proved by their observations and infection experiments that *Nosema apis* was capable of producing a fatal disease in these insects. The writer particularly desires to acknowledge the very great assistance he has received from Mr. G. W. Bullamore, who has throughout placed his time and energy and his exceptional qualifications at the disposal of the inquiry. Not only is he a bee-keeper of great experience, and an expert with a thorough knowledge of the bee-keeping industry in several parts of the country, but he has devoted much time to the study of bacteriology and has a very wide and accurate knowledge of the literature devoted to the structure, habits, and diseases of bees.

---

* For this and subsequent references, given in italics, see the "Bibliography," pp. 139-143.

The details of the investigations are recorded in the various sections, but a brief summary of the chief results may be given here.

The study of the records relating to the diseases of adult bees has shown that several outbreaks of disease closely resembling the epidemic under investigation have been described at various times in this country during the last two centuries. These outbreaks have varied in severity, duration, and distribution, though some of them caused immense losses of bees throughout the country. It is of interest to note that in 1858 bodies resembling the spores of *Nosema apis* were found in the intestines of affected bees by *Higgins* (1858), who regarded them as vegetable parasites. On the Continent similar outbreaks have been recorded from time to time, and several observers, notably *Dönhoff* and *Leuckart* in 1857, noticed similar bodies in the intestines of diseased bees from different provinces, and also regarded them as spores of vegetable parasites. In considering the view they took, it must be remembered that at that time the protozoa were almost unknown. The study of more recent publications has shown that outbreaks of disease, characterised by similar symptoms, have occurred from time to time in all parts of the world (Section II.).

Section III deals with the symptoms of the disease. It is shown that certain symptoms, such as the inability of some of the diseased bees to fly, the presence of numerous bees crawling on the ground in front of the hives, and the gradual dwindling of stocks, are common, but that many other symptoms have been recorded, and that no one symptom is characteristic of the disease. The only essential feature is the death of large numbers of bees, and often of the whole stock, especially during wet and cold periods of the year or during the winter months. It is further shown that the disease is probably endemic, but that owing to lack of observation it often passes unnoticed in mild seasons, the loss of the bees being attributed to cold, starvation, spring dwindling, diarrhœa, and other causes. It is only during severe epidemics that the disease attracts much notice. These epidemics are especially apt to make their appearance during cycles of wet and cold springs and summers, but continue subsequently for some seasons.

Zander (1911) and *Nussbaumer* (1912), working on the Continent, are both careful to point out that the disease cannot be diagnosed with certainty without the aid of careful microscopical examinations. We have independently come to the same conclusion.

Section IV deals with the relation of *Nosema apis* to the disease. It is shown that *Nosema* in its young stages (in summer) or in its spore stage can be demonstrated in specimens from the great majority of diseased stocks, and that it has seldom been found in specimens from healthy stocks. It is further shown that this parasite can frequently be found in queens and drones and in combs and honey from diseased stocks.

Section V, which deals with the life-history * of *Nosema apis* in the intestines and tissues of diseased bees, is necessarily of a highly technical character. The parasites, after being taken into the intestinal canal as spores, usually enter the cells lining the chyle-stomach and multiply in them. When the life-cycle is completed the parasites develop into resistant spores, which pass out of the cells and are voided in the excrement. The infected bees often die owing to the effects produced by the growing parasites before the spore stage has been reached. In such cases the diagnosis can only be made by means of very careful microscopical study. Other resistant bees sometimes live till the cells of the intestine are so crowded with spores that the intestine has a white appearance. In most cases the bees which become infected die in a longer or shorter period, but occasionally they live for considerable periods, and act as "parasite carriers."

Section VI is devoted to the description of infection experiments. Since no method of cultivating *Nosema apis* outside the body of the bee has yet been devised, spores of *Nosema*, obtained from the bodies of diseased bees, were used. It is shown that the disease can be produced in healthy bees by feeding with syrup or honey containing spores, by contaminating their food with infected excrement, by allowing them to feed on candy previously used by infected bees, by placing bees dead of the disease in the cages occupied by healthy bees, and by confining healthy bees in cages in which diseased bees had travelled. By observations on infected stocks kept in captivity the variations in the symptoms were studied. Some of the experiments seemed to indicate that partially immune stocks exist which can only be caused to suffer from the disease with difficulty, but which may harbour the parasite and act as centres of infection for susceptible stocks.

---

* Statements such as the following have appeared in several papers: "The remarkable series of about one hundred studies of *Nosema apis* by Dr. Zander, should be a priceless guide to the students of this disease" (Macdonald, 15.i.1912). "As an instance in point, we can mention that Dr. Maassen has been able to produce over one hundred photo-micrographs, which show the whole life-history of *Nosema apis*, so that now we know all about this protozoon" (Editorial, 21.ix.1911, *B.B.J.*, Vol. XXXIX, p. 371). Mr. T. W. Cowan (30.i.1912) informed the writer that he had not heard of these photographs, and the latter has been unable to obtain any information about them. The work published in this Section is based entirely on original observations. Very little assistance has been obtainable from the short accounts which have hitherto been published.

In the sections just referred to it is shown that *Nosema apis* mainly develops in the cells lining the chyle-stomach, that during the process the cells are injured and often destroyed by the immense numbers of young parasites which are produced, and that the infected bee may die either before the parasite has reached the spore stage or after numerous spores have been formed. Further, it is shown that the disease can be reproduced in healthy bees by means of food and other materials containing spores, and that *Nosema* has usually been demonstrated in the intestines of bees exhibiting the symptoms of the Isle of Wight disease, but not in the intestines of bees from healthy stocks.

It can therefore be stated with confidence that *Nosema apis* is the agent responsible for most cases in which the symptoms of the Isle of Wight disease have been noticed or in which stocks have dwindled or died without apparent cause. In a small proportion of these cases the symptoms are no doubt due to other causes. We therefore suggest, since *Nosema apis* is a member of the group named the Microsporidia, that the term *"Microsporidiosis,"* proposed by *Fantham* and *Porter* (1911), be used to denote those cases of disease which are due to infection with *Nosema apis*.

Section VII deals with the ways in which the disease may be spread from bee to bee, from hive to hive, and from apiary to apiary. As far as possible the arguments are based on such observed facts in the life-histories of bees as seem to be likely factors in aiding the dissemination of the disease. On some points no direct evidence has yet been obtained, on some we have the evidence afforded by observations on diseased stocks, and on some the evidence afforded by the finding of *Nosema* spores or the results of infection experiments. It is shown that infected water supplies may be of great importance, and that moisture (rain-water, &c.) near hives contaminated with infected excrement is an especially potent source of infection. Nectar and pollen on flowers may occasionally be infected by foragers, and so cause the infection of healthy bees. During the process of manufacture and storage honey is liable to become contaminated, and spores have been found in stored honey and pollen. Both are therefore liable to act as sources of infection to healthy bees within the hive.

Further, varieties of honey unsuitable for wintering impair the powers of resistance of the bees, allowing the parasites to attack the bees with great severity during the winter months. Queens frequently become infected. Up to the present no evidence has been obtained to show that infected eggs are laid, but the queens deposit infected excrement, which is removed by workers, who consequently are liable to become infected. Drones also are frequently infected, and owing to their wandering habits are liable to carry the infection to other hives. The disease is probably often conveyed from hive to hive by infected foragers entering hives other than their own. Robbing is undoubtedly an important method of spreading the disease. For reasons given in detail later (p. 105), swarms often develop the disease before the parent stock. Spores may remain alive and virulent in old hives in which diseased stocks have died, and cause infection in healthy stocks which occupy such hives. "Parasite-carriers," or bees which remain alive and harbour the parasite, are very important agents in spreading the disease, though up to the present little attention has been paid to them. Driven bees obtained from infected districts have conveyed the disease on many occasions into districts previously non-infected.

It must be borne in mind that an outbreak of the disease is not due merely to the conveyance to healthy stocks of the spores of *Nosema apis*, but depends on the action of a number of factors, of which the following are probably the most important: the dose, the virulence of the strain of *Nosema*, the natural resistance of the infected stocks, the food supply, and the climatic conditions.

In Section VIII a number of observations on natural means of infection are quoted. Instances of naturally infected food and flowers and water supplies are given, as well as an instance of the conveyance of spores in dust blown about by the wind.

Section IX gives the results of the examinations of certain insects found in hives. Spores have been found in the excrement of wax moths and ants, though these insects do not suffer from the disease, but they were not found in the bodies of mites or ichneumons or in their excrement.

Section X deals with modes of treatment and prevention based on the observations detailed in previous sections. It is shown that drug treatment has met with little success, and that it is improbable that a successful method of drug treatment will be found. The methods of prevention most likely to prove of use are as follows: the provision of pure water supplies, the removal and destruction of all dead bees and infected materials, the disinfection of old hives, and the destruction of diseased stocks.

Further, the practice of replacing dead stocks in infected apiaries by healthy susceptible stocks should be abandoned, for by this means the disease is kept alive. Driven bees from infected areas should not be imported into non-infected areas. In infected areas an attempt should be made to build up apiaries from immune stocks.

In Section XI it is shown that mason-bees and wasps may succumb to infection with *Nosema apis*, and, further, that humble bees suffer naturally from a disease caused by a *Nosema*, but up to the present it has not been definitely decided whether this is *Nosema apis* or another species.

Section XII is devoted to the bacteriology of the disease. It is shown that *B. pestiformis apis* can often be found in the intestines of diseased bees, and that greater numbers of bacteria are present in the intestines of diseased bees than in those of healthy bees. There is no evidence, however, that in this disease bacteria play anything but a secondary part.

The writer is well aware that many problems connected with the disease and its spread yet remain to be solved, and that some of the observations and experiments require confirmation and repetition, but he believes that what has already been accomplished has added considerably to our knowledge of the diseases of adult bees, and hopes that subsequent observations will further add to that knowledge.

The writers of the various sections or sub-sections are responsible only for the statements made under their signatures. Most of the work has been carried out in the Pathological Laboratory, Cambridge, and over this the writer of the introduction has exercised a general supervision. The work of Drs. Fantham and Porter has been mainly carried out elsewhere, and they are entirely responsible for Sections V, VI (Sub-section A), VIII, IX, XI (Sub-sections A and B), and XIII.

SECTION II.

THE HISTORY OF THE DISEASE.

By G. W. BULLAMORE and W. MALDEN, M.D.

The introduction of the frame-hive into bee-keeping in this country by Tegetmeier, in 1860, and its general acceptance as the "Woodbury" hive (*Neighbour,* 1878), have facilitated the examination of stocks. Many losses from scarcity of food, leaky roofs, &c., have been prevented, and it is now generally believed that the spring losses are due to lack of attention. The use of bar-frame hives has shown that disease of the brood is fairly common, and consequently the bee-keeper has been led to blame foul-brood for most of the lack of success which he at times experiences.

Though foul brood was known in English apiaries prior to 1863, in that year it was first regarded as the cause of the excessive mortality of bees in this country. *Woodbury* (1862–3), whose apiary was rapidly dwindling with symptoms of dysentery and abdominal distension, discovered that brood disease was also present, and attributed his losses to foul brood. Since that date the diseases of adult bees have been regarded by most writers as of little consequence compared with diseases of brood. With regard to this subject it is significant that *Leuckart* (1860), writing about this time, says "that he was formerly of the opinion that foul brood was caused by the same fungus (*Panhistophyton ovatum* [*Nosema*]) which is noticed in a disease (pébrine) of the silk worm."

The earlier writers on bees in this country did not look upon brood diseases as contagious maladies, and often referred to diseases of adult bees, such as dysentery and abdominal distension and to the great mortality in February and March. These troubles could not be satisfactorily attributed to unsuitable climatic conditions, since mild and severe winters, damp and extreme cold were all blamed by different writers. Some thought that dysentery was contagious, some that it was due to an excess of honey, some that it was due to a lack of it, and others that it was due to a lack of pollen. *Thomson* (1882), the well-known "Lanarkshire Bee-keeper," described two diseases of adult bees, "abdominal distension, which in many cases is erroneously termed dysentery," and chloric dropsical fever (the "dropsy" of Woodbury), which he discovered in 1860. He states that one form of the former disease "is common in Scotland when the bees have access to the heather." In the latter disease, which he regards as hereditary, he describes the abdomen as distended with sub-acid saltish fluid. He also ventures the opinion that "the disease termed vertigo is one of the stages of this disease," and remarks that "about the month of October the strongest hive will be defunct in two or three weeks."

Dzierzon (1882) says that the bees are attacked by vertigo towards the close of the fruit bloom, and show symptoms of poisoning (see p. 23).

More recent text-books do not mention these diseases. When the bee-keepers of the Isle of Wight in 1906 described an epidemic, which was devastating their apiaries and of which the symptoms were abdominal distension and inability to fly, their statements were received with incredulity. They, however, brought the matter to the notice of the Board of Agriculture and Fisheries, and Mr. A. D. Imms was appointed to investigate the outbreak. His report (*Imms,* 1907), and subsequently that of *Malden* (1909), showed that the statements as to the deadly character of the visitation had not been exaggerated.

The disease appears to have been first noticed in several districts in the south-eastern corner of the island in 1904 (*Silver,* 1907), and to have spread gradually to the centre and north. At the time of Malden's visit in 1908 most of the original island stocks had perished.

In 1909 the disease was reported for the first time from mainland apiaries in the counties nearest to the Isle of Wight. In a paper read before the British Bee-keepers' Association in March, 1911, one of us (W. M.) announced that cases had then been recorded in the South of England, East Anglia, and Wales, and in several northern districts, into which it was thought to have been introduced with bees from the south.

A more careful scrutiny of the records and a more extensive knowledge of the symptoms have convinced us that the view that all cases can be traced to the Isle of Wight outbreak is no longer tenable. We now know that the disease manifests itself in various ways, but even if we restrict ourselves to cases of the disease accompanied by crawling symptoms, we can show that the trouble was not unknown on the mainland prior to the Isle of Wight outbreak. In the Peak district of Derbyshire in 1902 bees were crawling on the ground in March, although "the thermometer registered 50° at 10 a.m." "In the evening the ground was strewn with corpses" (*Beginner*, 1902). The disease evidently persisted in this county for "wholesale losses" were reported in 1906 (*G.W.G.*, 1906, p.260). In 1903 a case near Sheffield was described in the following words:—

> "The bees have been dying off from the hive nearly all summer; they seem to stagger out of the hive and roll off on the ground and crawl about until they die." (*Puzzled*, 24, xi., 1902.)

In 1905 some stocks were lost in an apiary near Old Sarum, Wilts, from "Charlock poisoning," and a neighbour suggested it was due to starvation (*Old Sarum*, 1905). Both explanations have been freely used to account for the losses of apiaries from Isle of Wight disease. In this year also "bee-paralysis," which disappeared with the advent of warm sunny weather, was chronicled from Scotland (*D.M.M.*, 1905). In 1906 the following observations were made in regard to the behaviour of a stock in Scotland:—

> "hundreds of the young bees come out every day crawling feebly about. If it is a sunny day they gradually gain strength and return to the hive. If it is cold, sunless, or with a strong wind blowing, so many appear to succumb that the ground round about is strewn with their corpses." (*D.M.M.*, 1906, p. 312.)

It is interesting to note that this trouble was accompanied by heavy losses from spring dwindling, and from stocks dying out from paucity of numbers (*D.M.M.*, 1906, p. 352), although the Isle of Wight disease is said not to have been imported into this apiary till 1907. A swarm then imported did good work up to September, and died out in the following May (*D.M.M.*, 1911, p. 145). In 1906 *Reed* described a disease which had been present in a stock in Essex for five years:—

> "The bees nearly all died off. They crawled from the hive on to the flight board and died there; at least, about three pints of them did, but the queen and a few bees came through the trouble and made a good stock, but yielded no honey. The following winter the bees again became affected as before, and nearly all died off in the same way. The bees seem as if suffering from abdominal distension when they leave the hive."

In August, 1906, bees were dying in an unaccountable manner outside a hive at Anerley (*A.W.*, 1906, p. 319). *Stapleton* (1911) says that Isle of Wight disease was present in his district in Cornwall in 1904, and in a few years reduced his apiary from about sixty stocks to fourteen. In 1907 outbreaks occurred simultaneously in three apiaries in Hertfordshire which were several miles apart (*H.S.*, 1908, p. 126). From several counties information has been obtained which shows that the disease was present long before it was recorded by the County Bee-keepers' Associations.

The reports we have received during the course of these investigations clearly show that no one symptom is characteristic of the Isle of Wight disease, the only essential feature being the death of large numbers of bees within or without the hive. Further, the observations and experiments recorded in the following sections indicate that *Nosema apis* is the causative agent in most attacks of diseases accompanied by the loss of large numbers of bees. We are therefore inclined to think that the large losses of bees so often described in recent years in various parts of the country have been due to *Nosema* infection. We further think that from its commencement the epidemic was more widespread than was at first supposed, and we believe, from the evidence we have been able to collect, that the disease has been endemic in parts of the country for many years.

A review of the literature of bee-keeping shows that heavy losses of bees have been experienced from time to time. In the following quotation from Macdonald (1905) a number of these bad bee seasons are mentioned:—

> "*Some Bad Bee Seasons.*—It would be an interesting study, if one had the time and opportunity, to determine if these come in cycles. Fragmentary as the few statistics I am able to produce are, they serve to show us at least that, say, for the past twenty years, we have had no undue proportion of these. Butler records that 1611 and 1621 were bad years. From Purchas we glean that 1648 and 1651 were not favourable to honey gathering, and that they were inimical to bee life. In the first year 'the perpetual rains washed away all the substance in the flowers, so that not only swarms but old stools perished.' He himself lost about half a hundred. In the latter year, 'of twenty swarms he obtained before mid-May, only one solitary one survived till next year.' All others had died. As pointing out the cause of loss, we are informed 'the most temperate weather occasions a greater decay of bees. Gloomy, cold, and close weather shuts them up and saves stores.'
>
> "In 1759, after the winter, there were great losses, but Mills attributes this not to the bad winter, but to the bad summer which preceded it. 1782–3, and again 1788, must have been bad. In one case, in the latter year, we find fifteen out of sixteen dying out. I merely pick these out of a goodly number taken almost at random. About a century ago they seem to have had a run of unpropitious bee seasons. Here are a succession of them:—1806, 1810, 1815, 1820, 1824, 1828, 1829, 1833, and 1837. I could multiply examples, but bald figures make dry reading. Some of the reasons, however, given for the failures may be interesting:—'Spring came so slowly up our way.' 'The continuous rains washed out the nectar.' 'The summer was so dry that vegetation was for most burnt up and failed to secrete.' 'One year the winter was so moist and mild, it wore out bee life'; another the 'late gathering led to great devastation from dysentery.' Superabundance of moisture did the mischief one year; drought proved as destructive another."

To account for the occurrence of dysentery and the death of well-provisioned stocks exercised the ingenuity of the older writers, many of whom describe widespread losses. *Bevan* (1827) says that:—

"In the winter of 1782-3, a general mortality took place among the bees in this country, which was attributed to various causes; want of honey was not one of them; for in some hives considerable store was found, after the bees were gone. Some were of opinion that it arose from the preceding being a bad breeding year, and thought the bees died of old age. Others attributed it to the moistness of the spring of 1783, which rendered the providing of pollen difficult, for without pollen no brood can be raised. The difficulty of collecting pollen was ascribed to the continual closing of the flowers over the anthers, the want of sun to burst the anthers, and the washing away of the pollen by the frequent showers after they did burst. The fatal influence ascribed to the wetness of the spring of 1782 seems to be improbable; though the wet might have affected the quantity of bees bred, it was not likely to put a stop to their breeding altogether, and the young bees ought at any rate to have escaped the desolating evil, if it were old age alone; yet wherever the mortality once made its appearance, every bee became its victim."

Keys (1780) devotes a chapter to the great mortality of bees in winter and spring. He attributes these losses to the changeable weather:—

"The frequent and often sudden transitions from one extreme to another prove more fatal to the delicate constitutions of the bees than a series of any one kind of weather whatever." He further tells us that the weather of 1777 was cold and wet "until July, the last day of which was so cold, wet, and windy, as to require fires being made in the parlours. . . . To complete the misfortune, the ensuing autumn and winter were also very unkindly, being replete with damp foggy air; this, as all the stocks were very poor, and scanty of numbers, affected the weakest very severely, causing a fatal purging, which destroyed many before I could find a remedy."

The remedy was the placing of ashes and straw on the floorboard to keep the bees from soiling themselves on alighting. He also discusses pure honey as a cause of dysentery in the following words:—

"Several late authors have supposed honey the only and best food for bees. This Monsieur Reaumur disputes, from the instances of stocks dying, though surrounded with combs of honey; from whence he draws the conclusion that honey alone is too lax a diet unless assisted by farina, which he characterises as the true bee-bread. I apprehend the objections are as great against the farina as the honey; for if farina be absolutely *necessary,* how it is that more bees die in spring when plenty of fresh farina may be procured, than at any other season of the year? Many of my stocks have often failed, although they had a sufficiency both of honey and farina.

"Besides, I have often supplied poor stocks with double the quantity of honey to what any of my other stocks had in their hives and yet they perished in the spring." He considers that "the bees, allured by a sudden and too large a supply at once, and obtained without labour or pains, gorge themselves so as to bring on a fatal laxity; the very disease your care and kindness intended to prevent. It is probable, however, that the purging does not always arise solely from excess, but sometimes from a previous weakness, attended with a retention of the perspirable matter occasioned by a damp, cold air."

Dyer (1781) says that bees

"are more subject to sickness in the months of February and March, than all the year beside. Many people think their bees die of cold at this season, though in reality it is of famine; and yet this seems strange when there is plenty of honey in the colonies, and even that which is very good; but I will point out in a very plain manner the probability of such a death. The reason is this: bees, like a human being cannot live upon bread alone, neither upon drink only, at this season perhaps all their bee-bread, or crude wax is spent, if so, unless the fields or gardens furnish them with more they will soon come to destruction by eating honey alone."

Bonner (1795) says:—

"I have known bees do well that had been confined in their hives for five months even in this country, while others of them were ready to perish, by retaining their fæces for so long a period. Sometimes about Martinmas I have seen four hives standing in one place, all equally thriving and numerous; but in consequence of having been confined by bad weather for six or eight weeks after that period, one of these hives would have had several hundreds of dead bees, lying swollen on the stool, while the other three were in a thriving condition, and had scarcely a dozen dead bees in each. Upon tearing one of the dead bees asunder, I found her intestines quite full of fæces, which I therefore conjectured was the cause of her death; whereas the intestines of the thriving bees had very little matter in them, and therefore I am inclined to think that this was the reason of their continuing healthy and active. Whether the original disease of the former class, and their premature deaths, proceeded from their gluttony in gormandising more food than was necessary, or whether it was an epidemical disease that had got in among them, and carried them off in such numbers, I will not presume to determine; though I rather incline to the former opinion. But from whatever cause the disease proceeds, such hives often lose their inhabitants at the rate of a dozen or more per day, till they are greatly reduced or perhaps quite desolated at last."

The writer of "Comfort to Aristeus" (1800) attributes the losses of stocks of bees to

"the country being overpastured with them, and the owners look in vain for other causes. . . . Only a certain number of hives, like a certain number of men, or cattle, can be kept in a part of a country, for they must be proportioned to their foliage, and when they are over-rated they die by disease and famine, being obliged to suck unwholesome herbs, which cause disorders and death. . . ."

Microsporidiosis is essentially a disease of crowded districts, and the above extract is therefore particularly interesting.

It is interesting to note that nearly a hundred years ago authorities on bee-keeping were unable to believe that heavy losses were possible from disease. *Huish* (1821, p. 95), for example, makes the following statement in a footnote:—

"In a letter recently received from Mr. King, Brill, Bucks, he mentions having lost one hundred and fifty hives by the dysentery; some strong suspicion rests upon my mind that the bees had been benumbed by the cold, and that Mr. King concluded that they were dead. It is an unheard of mortality by the effect of a particular disease."

The same author (*Huish*, 1844), at a later date, makes the following interesting statement:—

"It has been asserted by several apiarians that the dysentery is contagious, and that the bees of one hive will communicate the malady to those of another; we, however, conjecture that this opinion has arisen from the circumstances that several hives in the same apiary have been affected with it at the same time, the real cause of which most probably was that the bees of all infected hives became subject to the same malignant influences and consequently were subject to the same disease."

A *Lanarkshire bee-keeper* (1889), commenting on losses of bees, remarks that 1860–61–62

"were a great deal more unfavourable to crops and bees, and about fifty years ago there was one of the most disastrous years experienced. Crops were late and bad, bees almost died out. In two parishes there were about 500 hives; out of that number only five were saved, one out of 300, and four out of 200. The following year one of the individuals who saved two increased his stock to eight or nine and sold £14 worth of honey, realising 2*s*. 6*d*. per lb."

From the columns of *The Field* * we can learn the circumstances attending the losses in the early 'sixties. *Correspondents relate their troubles in much the same language as the bee-keeper of the present day.*

"My bees, after having shown full activity until now, crawl out and die on the alighting board" (27, iv., 1861, p. 351).

---

* For interesting correspondence on this subject, see *The Field*, 1861, Vol. I, pp. 116, 351; and 1862, Vol. I, pp. 326, 555, 590, and Vol. II, pp. 42, 63; and *Journal of Horticulture*, 1861, p. 468; 1862, pp. 187, 226, 245, 487, 508; and 1863, pp. 180, 502.

> "Yesterday I observed them unusually busy, and returning to the hive, not only laden with very yellow pollen, but covered with it, especially about their heads, so that their appearance was quite yellow. A few hours afterwards I revisited the hive and found several thousands lying beneath it dead and dying, and this still continues. I have no doubt but that they have been poisoned, as their appearance not only bears this opinion out, but there can be no other cause. They crawl out of the entrance, fall off apparently from stupor, and die in a few minutes after a kind of convulsive fit" (21, vi., 1862, p. 555).

In the *Journal of Horticulture* for 1862 and 1863 evidence is to be found that bees invariably dwindle in certain districts, and we also find inquiries relating to abdominal distension in bees. *Fairbrother* (1862), relating his experiences of dwindling in the spring, states that the old stock and the casts (headed by young queens) perished before the swarm headed by the old queen. He says that such losses occurred regularly every year, and he concludes in the following words:—

> "When I was in Oxfordshire some years back the same complaint was made to me of bees kept at the seat of Lord Churchill in Cornbury Park. I have had bees by rail out of Oxfordshire and out of Kent, which have done well for some time and then abandoned their hive as described."

Another correspondent (p. 226) describes his experiences of a similar trouble, in the following way:—

> "Hardly a bee was there; not as in the case of damp, where lots of putrid bees are found on the floor-boards, but downright desertion. There was in each hive honey tolerably plentiful, and in one instance a queen remaining with a few forlorn bees."

From another correspondent (p. 245) we learn that, at Perry Hill, Sydenham, Bexley, and Plumstead Common, apiaries were regularly visited with a similar trouble.

The *British Bee Journal* was founded in 1873, and its volumes afford evidence that the bees in whole districts have died out in the past, the trouble usually being ascribed to starvation. Many cases are recorded, however, of bees dying of dysentery or of abdominal distension when there was ample food in the hive. The interesting quotation which follows is from the August number, 1881 (p. 65):—

> "*Paralysis in Bees.*—We have heard of several cases of what appears to be paralysis of the wings of bees, which threatens to decimate the hives to which they belong, hundreds lying about the apiary, rendering it impossible to walk about without treading some to death. There is no dysentery or abdominal distension, and the bees take food when offered, but cannot fly. There is no appearance such as one would expect from poisoned food, nor is there any

deficiency of food in the hives. The bees come out to take their flight, and fall to the ground, and are unable to rise again. It appears to be worse in the morning after a previous day's confinement at home through wet or cold weather. Can anyone throw any light upon the cause of the malady?"

In the following spring a correspondent of the *Journal of Horticulture* (27, iv., 1882, p. 352) complains of the dwindling of his three stocks, and says:—

"One very strong hive with a last year's queen lost over a quart of bees and the queen also. The queen not being dead, I took her from amongst the dead heap, and placed her in a bell glass in heat; she was purging at a great rate. . . . This was a very strong hive, with all their own honey sealed since August, 1881."

We think that the foregoing quotations show that outbreaks of disease exactly similar to the present one, characterised by heavy losses of bees, have been recorded in the past, and have been most noticeable in poor seasons. There are consequently good reasons for thinking that the present epidemic is a severe outbreak of a disease which has been endemic in the country for many years.

The fine summer of 1911 caused a great decrease in the number of cases of the disease for a time, though the bees succumbed in the autumn and winter, in some cases after yielding surplus. It is not difficult to understand how the disease escapes detection in normal years. The sudden death of the stock during winter is one form taken by the disease. The editor of the *British Bee Journal* says (1905, p. 150) that "it is not uncommon to find bees dead in early spring with plenty of stores in the hive," because the bees cluster away from their stores. In some cases this explanation may be correct, but in a certain proportion nosema infection, aided perhaps by cold, is the cause of death. Spring dwindling, probably often due to weakness from disease, is a common complaint in some apiaries.

Every summer large numbers of bees die while at work on the lime-trees, &c., and no explanation has yet been found for these wholesale losses. Weak stocks united in the autumn and helped by feeding must assist in perpetuating this disease. Thousands of stocks perish annually, in normal seasons, as shown by the reports of the County Bee-keeping Associations, and among the number there is little doubt that the endemic forms of the disease escape detection.

A disease of adult bees is known in Ireland under the name of paralysis. *Moroney* (1903) mentions the case of a bee-keeper whose "bees died out after all known remedies had been tried, and he is obliged to buy swarms every season to keep up the number of his stocks."

THE PRESENT DISTRIBUTION OF THE DISEASE IN ENGLAND AND SCOTLAND.

During 1911 numerous reports were received from most parts of England and Scotland showing that the disease was very widely distributed. In some districts almost all the bees had been destroyed, while from others only a few cases have been reported. The exact distribution of the disease is, however, difficult to determine, owing to the fact that the condition of bee-keeping in many districts is very inadequately reported. The results of the examinations of diseased bees are given in Table I (p. 42), from which it will be seen that *Nosema* infected bees have been received from most parts of England and Scotland.

Owing to the prominence given to the disease in the Isle of Wight, we think it desirable to give a short account of the condition of bee-keeping in the island. The statement that the original island strains have all perished is not absolutely correct. Small areas in which the bees have remained healthy have existed from the beginning. In 1911 there still existed two apiaries tenanted by original island strains, which had escaped the disease. One of these, situated near Freshwater, was visited by one of us (G. W. B.) in 1911. The bees were all descendants of a swarm of 1903. By natural swarming they had increased to eight stocks. In other apiaries bees of unknown origin, the produce of stray swarms which had occupied empty skeps or "pots," had remained healthy. A bee-house near Newport had been tenanted for thirty years, but four years ago all the bees died with paralytic symptoms. A stray swarm took possession of a box in this bee-house, and remained healthy. A swarm from this lot hived itself on old combs in another box, and also remained healthy.

After the heavy losses from the epidemic during the years 1906-7, a fund was started on the mainland for the purpose of re-stocking the island. Sixty lots of bees were despatched in 1908, and were distributed among the bee-men of the island. The majority of these stocks appear to have succumbed, but in one apiary a stock had increased by natural swarming, and when the apiary was visited in the autumn of 1911 it contained six healthy skeps of bees, and, in addition, five swarms had been despatched to different parts of the island, and were reported healthy. The bees were of the small black type, showing no admixture of foreign blood.

At the present time there are about two hundred and fifty stocks on the island, which are the property of about fifty bee-keepers. During the summer and autumn about forty apiaries were visited. We take this opportunity of thanking the owners for the readiness with which information was given, and for permission to examine stocks. Very little disease was in evidence, and one beekeeper succeeded in obtaining 300 pounds of honey from his best stock. With the return of wet weather the trouble has again shown itself in many apiaries, and according to Mr. H. M. Cooper it is now as bad as ever.

We think it improbable that bee-keeping will be restored to its former prosperity until the practice of introducing bees into dwindling apiaries has been abandoned (see Section X).

DISEASES OF ADULT BEES IN OTHER COUNTRIES.

The reports to which we have had access show that adult bees, in most countries in which bee-keeping is practised, are subject to diseases characterised by symptoms resembling those which have been noticed in this country. Such terms as paralysis, May-sickness, &c., have no definite significance other than that large numbers of bees die in front of the hive. In other countries, as in our own, the mortality is sometimes attributed to poisoning, and where the spraying of fruit-blossom or of charlock is not practised, the nectar of the plants in blossom at the time is suspected of possessing poisonous qualities.

While it is possible that with a greater knowledge of the bacteriology of bee-diseases other organisms will be found which are pathogenic to adult bees, we have little hesitation in expressing the opinion that many of the losses in other countries are due to the presence of *Nosema apis*. In Germany, Switzerland, America, and Australia *Nosema* has been found, and in the two former it is recognised as an agent in the production of disease. So far as we know, special search has not been made as yet for this organism in France, Italy, or America.

France.

In speaking of May-pest, Cowan (1907) says that

> "in 1853 and 1855, after wet and cold springs, an epidemic of this disease raged in France and neighbouring countries, and about ten years later an attack of such severity occurred in some cantons of northern France that the number of hives was reduced to one-third, and in some places to a fourth."

That the disease still breaks out from time to time is shown by some recently recorded cases. *Pons* (1911), the president of the society "L'Abeille Arlesienne," relates that in 1909 the majority of the apiaries were attacked by a disease which he calls paralysis, and which, in his opinion, is the disease called by others *mal de Mai*, constipation, or vertigo. He adds that at the last stage of the disease a large number of the bees have dysentery.

D'Autemarche (1911) prints a letter from Desmarest, a bee-keeper of the Ponts-de-Cé, which records the loss of twelve stocks. "Until now I have never lost one while wintering. Now I find them all dead, fallen on the floor-board each with 3 to 6 kg. of sealed provisions remaining."

Germany.

Berlepsch (1873) affords evidence of the existence in his day of a disease that resembled *Nosema* infection:—

> "After the bees in the spring of 1859 had flown cheerfully for a time and had made good use of the sallows they suddenly died in masses. Whole heaps were found on the ground, their wings fluttering, streaming with watery excrement, and incapable of moving themselves. Of those that flew out not a half returned, and at last only four or five were left with the queen. Many hives were one day healthy, the next day half were dead, and the next day again all were dead. The disease appeared in many places about Easter, and in many not till Whitsuntide; it was similar to human cholera, ravaged whole neighbourhoods, in the whole of South Hanover, and the lands adjoining, even in Denmark. It was especially noteworthy that in a neighbourhood one farm was often destroyed, while another close by was perfectly healthy. The disease must necessarily be infectious."

Dzierzon (1882) discusses the diseases of adult bees at some length. He considered that dysentery was at times contagious. Speaking of vertigo, he says:—

> "Towards the close of the fruit bloom, which is a very critical time for bees, Nature appears often to prepare a poison for bees, so that in this district we often find at this time in the hive and outside a quantity of bees, mostly young, struggling with death. Whether the bees carry in the poison from the mountain-ash, from the crow-foot, or the apple, which bloom at this time, or whether it is a consequence of some night frosts occurring, has not yet been established."

He also relates that bees working on buckwheat lose the power of flying when the sky is overcast, though the temperature may be 65° F.:

> "but as soon as the sun shines and temperature becomes warmer they rise immediately and fly briskly into the hive. . . . Another phenomenon, which has only been observed here once, appears to be similar to this, but, on the other hand, to be essentially different from it. In this, it is not the bees arriving loaded, but the bees coming out of the hive that fell; and instead of remaining quietly settled, fluttered about impatiently, so that they were collected in depressions in front of the apiary in considerable numbers. They do not appear to have regained ability to fly. Perhaps it is the same evil of which bee-keepers on the heath so frequently complain, which they call *Fussgangerei* (footing it instead of flying); and whereby the hives, under

certain conditions of weather, are sometimes considerably depopulated."

The work done of recent years by Zander at the Erlangen Institute has brought out the fact that there are heavy losses of adult bees at the present day from *Nosema* infection, but, as pointed out by *Maassen* and *Nithack* (1910), the bee-keeper, though paying great attention to the health of the brood, takes no notice of losses of adult bees.

Switzerland.

Madame *Vicat* (1764) relates that:

"the farmer to whom she entrusts the care of her bees in the country lost a hive in the winter of 1763, in a manner that had never happened before. There was plenty of provision in the hive, and it was as well stocked with bees as any other. They did not die of cold, for the weather was warm, and they went abroad the day before their almost sudden destruction. Of eight hives which he had in another apiary, six perished in the same manner."

Bertrand (1909), one of the pioneers of modern methods of bee-keeping in Switzerland, speaks of a disease of adult bees in that country:—

> "One frequently designates by the name of mal-de-mai, a malady ill-defined and infrequent, which appears to be the same as that called by the Americans "paralysis," though it is generally more serious with the latter than with us. The bees drag themselves laboriously out of the hive; they are incapable of flight, and die after some hours, the abdomen swollen and full of excrement."

Nussbaumer (1912) says that disease due to *Nosema* is common and that badly infected bees carry pollen, honey, &c., like the rest. At times they fall from the flying board and die in convulsions on the ground. He states that one fairly sure symptom is high mortality amongst the bees, and that the disease cannot be diagnosed with certainty without the microscope. He considers, however, that May disease differs from *Nosema* infection, as the bees suffering from May disease suffer from distension of the abdomen caused by the accumulation of masses of pollen in the colon. There is no evidence in his paper that he recognises the young stages of *Nosema apis*, which so commonly produce fatal disease in the warmer months, without the development of spores.

He has observed the symptoms of *Nosema* infection in the following cantons:—Waadt, Freiburg, Berne, Lucerne, Solothurn, Aargau, Basle, Zug, Uri, Schwyz, Unterwalden, Zurich, Glarus, and St. Gall, and thinks that the disease is probably present in other cantons also.

Italy.

Writing of *mal de Maggio, Dadant* (1907) says:—

> "In the province of Ancona, Italy, during the years 1901–05, entire apiaries were depopulated just at the opening of the honey harvest by this strange malady. This is a disease of the adult bees, and not of the brood."

America.

Cases of bee-paralysis are often recorded in the United States, but the term has no very definite significance. *Phillips* (1911) says that it is quite possible that under the name "paralysis" are included several distinct diseases. *Dadant* (1907) speaks of a disease of adult bees which is akin to diarrhœa and at times epidemic. He says that this disease is known in different countries as bee-paralysis, vertigo-dizziness, *mal de Mai, mal de Maggio, Maikrankheit,* and *Bacillus Gaytoni* or *depilans.*

Root (1910) says that bee-paralysis

> "is much more prevalent and virulent in warm than in cold climates. Almost every apiarist in the north has noticed at times perhaps one or two colonies in his apiary that would show bees affected with it. Yet it seldom spreads or makes any great trouble; but unfortunately this is not true in some parts of the south and west. In the south it is known to affect whole apiaries, and seems to be infectious. . . . Repeated tests have shown that paralysis is never transmitted by the brood or combs, but that it is carried by the dead or sick bees."

Critchlow (1904) gives the following description of losses of bees in Utah:—

> "Is this a new and strange bee disease, or is it a very malignant type of paralysis? Possibly some purely local cause is responsible for the great mortality among the bees. Who can give us some light? There seems to be great danger in Utah of a total loss of the entire bee industry. I shall give you as nearly as I can the conditions, both in the past and at the present time.
>
> "In this valley and in the one fifty miles north of here, called Cache Valley, there have been for many years a great many bees, both in the hands of skilled operators and in the hands of many farmers and small owners. A year ago this spring there were upwards of 2,000 colonies of bees lost. It was thought a year ago that it was owing to the very cold winter weather and changeable weather in the spring; but the strange part of it is that in some localities not any warmer, but if anything, colder, the bees survived all right, with scarcely any loss at all.
>
> "I lost last year 300 colonies of bees, and in some localities in Cache Valley there were upwards of 500 colonies that went under; and in this valley (Salt Lake) last year there were fully 800 colonies that perished. It was thought by all those who were interested that it was due to the hard winter and cold spring."

This writer, who had lost nearly all his stocks, bought 225 colonies in a district that disease had not visited, and moved them into his apiary. He continues:—

"I was there yesterday, and a large part of the entire 225 colonies are affected with what appears to be paralysis. While there is no trembling, they drop down in the grass in front of the hives, and are unable to fly; they seem to mount the grass and twigs with great difficulty, and in taking them up in my hands they were unable to fly away, and, if thrown into the air, would drop to the ground. They seemed to have no desire even to sting. It appears to be contagious, for it seems to affect a certain part of a row, while another section of the row seems to be strong and swarming. A number of hives have all gone under. The entire yard, of course, is exposed for the reason that a few, perhaps twenty, colonies from what were left of the lot last year were put with them without any thought of anything being wrong, except that they were weak.

"I am fully satisfied now that the loss last year, which would number at least 2,000 colonies in Cache Valley, was due entirely to this condition."

Bedell (1909) describes the loss of his colonies in New York State. Two dwindled and died during winter, leaving plenty of stores, and two others developed crawling symptoms in October, but just managed to get through the winter in a very weak condition. He continues:—

"The trouble, whatever it may be, has affected this whole section for at least five miles around. I have visited several apiaries as follows: first one of 21 colonies, all dead except one, which is in very bad shape; another of 12 colonies, another of 17 colonies, all dead; another of 12 colonies, all dead except four, which are in bad shape, and three other apiaries of about 30 colonies, where the losses are not so great, but the colonies are very weak. . . .

"Some attribute it to the placing of some sort of crude oil on the marshes by the city authorities to kill mosquitos, others to the spraying of fruit trees when in blossom."

Fawell (1909) tells of some losses in Ontario, which may be another form of the trouble:—

"On the 21st of August I examined my 22 hives and all seemed to be all right, most of them working on the wild sweet clover. I went away for a week, and when I came home I found half of my hives deserted, and in six of them the millers (wax-moths) had wrought great havoc. Since then I have lost two more, leaving only nine colonies, and some of these are not so strong as they should be. They are Italian hybrids, generally inclined to be cross; but this year it seems as though they were too stupid to sting, no matter how handled."

"I have talked with several other bee-men, and all have different opinions as to the cause; but all claim a loss of from 50 to 99 per cent. One man has only one colony left out of 78. Another lost 21 —all he had. Some blame the spraying of the fruit trees; but I do not think that is the cause, or we should have lost early before swarming time instead of so late."

Paralysis is one of the drawbacks to bee-keeping in Florida, and it has a marked influence on the industry in California also. In this latter State spring dwindling is another trouble, but is not looked upon as a disease.

Brazil.

Hannemann (1909) states that Brazilian bee-keepers lose many colonies from some cause which is little understood. The mortality chiefly occurs in March and April, hundreds of stocks perishing in some apiaries. The affected bees are found dying outside the hives, and it is thought by some bee-keepers that their condition is due to the poisonous properties of the nectar of certain plants which are in flower at the time.

Australia.

For many years the diseases of adult bees have attracted attention in Australia, and they usually form one of the subjects for discussion at the annual conferences of the Victorian Apiarists' Association. *Beuhne* (1909) says that

> "spring losses have been, for the last ten years, the principal setback to bee-keeping in parts of Victoria and New South Wales. Since my first heavy loss about nine years ago, from the disappearing trick, I have kept this subject steadily in mind. . . .
>
> "This trouble is not new nor is it confined to Australia. The first trace I find of bees disappearing wholesale, leaving boxes full of honey, is in 1872, in the district in which I am now living. In America there is a district in one of the States (I cannot recall which) where bees do exceptionally well, but they always go under, and bees have to be brought from elsewhere. In the heather country in the north of Germany bees suffer heavily if wintered on heather honey. There are quite a number of causes which bring about losses of bees in spring and summer, and these losses are insignificant in comparison with those resulting from unsuitable food. . . .
>
> "Dysentery weakens colonies considerably when it occurs in a severe form. The symptoms somewhat resemble paralysis, for which it is mistaken by some bee-keepers. The dead bees, which appear in front of the hives, are swollen, but the wings are close to the body, and the legs in normal position, instead of wings and legs being spread out, as in the case of paralysis. In the bees affected with dysentery there is no trembling or quivering motion."

A year later *Garrett* (1910), discussing "Bee Mortality," is thus reported:—

"He had spring dwindling—it should not be called by that name. It comes any time of the year. Paralysis can generally be noticed by the swollen bees and by the shivery movement of many of them. Speaking of the district in which he lives, every apiary has the disease at times, and he has known whole apiaries to be wiped out, and nothing is said about it. He had been practically wiped out—reduced from 140 colonies to 70 weak ones. Another man who had 80 colonies in the pink of condition at Christmas time said to him, 'No honey for me,' and when asked why he stated, 'Lost almost all the bees; they are in great numbers outside the hive dead.' Is this spring dwindling?"

Beuhne, who introduced the discussion, stated that he had "had an instance of bees falling out of a hive in a short time after he had given them a comb of mouldy pollen," and in reply to one of the speakers said: "Whatever you like to call spring dwindling, it's only a name. The bees die in great numbers, and yet there are no symptoms."

This group of diseases is now occupying the attention of the Victorian Government's bacteriologist, but no definite decision as to the causes has yet been arrived at.

SECTION III.

SYMPTOMS.

By G. W. BULLAMORE and W. MALDEN, M.D.

The first mention of an epidemic among the bees of the Isle of Wight appears to have been made by *Yank* (1906), who describes the bees crawling in the autumn, and the death of the stocks after packing down for winter. *Cooper* (1906) says that "the abdomen of the affected bee is not distended in every case, while the wings are often twisted back, having the appearance of being dislocated." He also states that a hive "since becoming affected with paralysis has developed dysentery, and the bees are rapidly dwindling." *H. M. C.* (1906) writes as follows in June:—

> "Here, in the Isle of Wight, there has been raging during the last year or so, and especially during the last five months, an epidemic of the above disease (paralysis), with the result that about 75 per cent. of the stocks are now dead. I find the symptoms are exactly as described in the 'Irish Bee Guide.' In some cases several hundreds of bees are to be seen on the ground near the hive, often crawling rapidly, but quite unable to fly, their abdomens greatly distended, and containing a large amount of ropy, yellowish-brown matter. The stocks affected rapidly dwindle and usually succumb in about a month or six weeks, leaving their stores and often a quantity of brood. The queen appears to keep healthy, and survives to the last. Although re-queening and other remedies have often been tried, in every case, so far as I am aware, the results have always been fatal. I am now treating some bad cases with sulphur, but have not met with much encouragement yet."

It was afterwards sought to distinguish this disease from paralysis, May-sickness, and dysentery, and it was described as a new disease. A correspondent of the Board of Agriculture and Fisheries thus describes the differences:—

> "*Bee-paralysis.*—I have not observed the trembling motion of the limbs typical in bee-paralysis. *May-pest.*—No grey dust-like fungus on the bee has been remarked. *Dysentery.*—None of the signs present."

Such restrictions in the use of these terms, however, are scarcely justified. *Bertrand* (1909) looks upon *Mal de Mai* and paralysis as interchangeable terms, and in America cases of paralysis are described where there is no trembling of the limbs. If, as has been suggested, *Nosema apis* is a cause of May-pest, the presence of a grey, dust-like fungus is not a sign. We find, too, that the term dysentery is often used to include abdominal distension or "dry dysentery," in which there is no soiling of the hive.

After studying a large number of descriptions we are unable to mention any one symptom which is invariably present. In some of the losses the only feature noted has been the disappearance of the bees. The loss of two hives in November is thus recorded:—

> "I have two hives of bees which have been strong till three weeks ago, when I examined them to find one hive empty, with the exception of a few straggling bees, and on looking at the other to-day I find they are all gone. I can only see one or two dead ones on the ground. If they have had the disease, do they go away to die?"

Some correspondents describe the loss of bees as dwindling:—

> "Since the end of January I have been amazed by the rapidly dwindling condition of my stocks, and have sought to rectify things by uniting weak stocks. I now see that I acted improperly in so doing, but did not realise until lately what an extraordinary disease I had to deal with."

The following quotation describes a somewhat similar case:—

> "The frame hives were closed down at the usual time last autumn, and each contained a very good strong stock of bees, apparently healthy. Later on it was found there were outside two of the hives a number of dead bees—more than would have reasonably been expected—and on opening the hives the bees had nearly all disappeared, very few indeed being left, and these mostly dead or in a dazed condition. There was plenty of natural honey for food, and nothing apparently to account for the depletion of the stock. At that time the third hive was examined and the bees appeared to be in a sound, healthy condition, with plenty of stock, but on being again examined in January, the condition was found to be exactly similar to that of the two hives above described."

In some districts dwindling is fairly common in the spring, and we think it should be looked upon as a disease, under cover of which *Nosema* may spread through an apiary. Although we quite agree that lack of stamina, entailing heavy losses of foragers, may arise from other causes than nosema, such stocks cannot be looked upon as healthy. The various guesses as to the cause of dwindling break down when applied to particular cases. Some think that an aged queen is the cause, but cases of dwindling are recorded when young queens are at the head of the affected stocks.

Others look upon it as due to the age of the workers, although it is evident from the amount of brood which gets chilled in some cases that the bees were young enough to undertake brood-rearing duties.

The most commonly recorded symptom is the presence of large numbers of crawling bees with distended abdomens in front of the affected hive. A robber bee emerging from a hive with a load of honey will sometimes run up the hive front apparently to get a better "take-off." It is probably for the same purpose that these crawling bees climb to the tops of twigs, grass-stalks, &c., The crawling bees are most numerous during the spring months and in the autumn. An apparent recovery of the stocks often takes place during the honey-flow. This was very noticeable in 1911. In a communication recently received about stocks which were rapidly dying, the following words were used:—

"The fact remains, however, that, with me at least, they overcame it last summer (about end of May) and quickly multiplied, and *never* worked so hard in any previous year, *but no swarms*."

The term "crawling," which is so frequently used, is not a very good one, for sometimes the affected bees are said to "run rapidly," or to be "unable to fly," or to "drag their hind legs, apparently unable to use them." Young bees may be unaffected in some cases; in others, "the bees just hatched drag their legs like the older ones, and some quite young bees were found outside on the ground, dead."

Sometimes the bees are scattered and die in ones and twos, while in other cases they collect in small clusters, and as a consequence the dead are arranged in heaps. Though this condition may be brought about by improper food, and also by starvation, where these causes can be excluded it affords fairly reliable proof, so far as our knowledge goes, that *Nosema* is present. It is, of course, possible that there are other diseases of adult bees which produce weakness, and which therefore manifest themselves in a similar manner, but up to the present we have no evidence regarding these.

The symptoms just described were the chief ones noticed in an apiary which was lost in 1910. It is important to note that the weather of that year was very unfavourable to bees. In considering isolated outbreaks, we must remember that the presence of an exceptionally virulent strain of the pathogenic organism, or a strain of less virulence acting on a susceptible race of bees, may cause the disease to sweep rapidly through an apiary. We give an account of an extremely severe outbreak in the bee-keeper's own words:—

"In June, when the bees were so busy, I saw in front of one hive, one of the strongest, the bees lying on the ground in bunches of one or two hundred, and the next one to it soon went the same; and then another in quite a different part of the apiary, and then another, making four. I did not see many more until August, and then they went all round these four on both sides. I kept blocking the mouths of hives up and taking them away from the others, but it seemed no good. They went like dew against the sun. I do not know how many are dead, but somewhere about a hundred lots I think, and I keep finding fresh ones every time I go and look at them."

Abdominal distension appears to result from the inability of the bee to fly. The loaded condition of the bowel when a bee leaves the hive may be the normal result of long confinement during winter and wet weather, and of the preparation of brood food at other times. (The preparation of brood food necessitates the consumption of large quantities of pollen.) The bee voids its excrement while on the wing. If, however, it is unable to take a cleansing flight, the bowel remains loaded. We do not think, therefore, that undue prominence should be given to this symptom. The really suspicious circumstance is that the bee is unable to fly. We have good evidence that bees affected with *Nosema* but still able to fly, can defæcate.

In some cases the affected bees appear to lose control of the sphincter muscles of the bowel, and the combs and hive-parts are soiled with excrement. Some observers have noticed minute quantities of excrement on the tips of the abdomens of both worker and drone bees in affected stocks. Dysentery should always be looked upon with suspicion, though it is sometimes caused by yeast-like organisms which set up fermentation in the contents of the bowel. The markings of dysentery are of all shades from cream to dark brown. The spread of disease by means of spores in the dysentric material is discussed later (p. 97).

Outbreaks in which the first symptom noticed was dysentery have been recorded. For example, a correspondent writes as follows in April, 1910:—

"I went through the stocks on Saturday and am very pleased to say that they all appear clean and healthy (and good numbers), except two lots which are few in numbers; these two have evidently just managed to survive the trouble. They have both a small patch of brood and eggs, which is of a nice bright colour. I lost altogether seven stocks. The appearance of some of the combs in these hives was as if they had been burnt, and the bars of the same combs looked as though they had been coated with tar. I think it was a bad case of dysentery. I heard last week that others had lost hives in a similar way."

Within twelve months of the date of this letter the apiary, which originally comprised thirty stocks, had been destroyed.

A form which the disease may take, and to which the bee-keeper may attach little importance at its first appearance, is the death of the bees and queen in the hive after packing down for the winter. In cases where the stores are scanty (and affected stocks sometimes obtain very little honey, probably owing to the loss of foraging bees) the mishap may be attributed to starvation. But it is not uncommon for bees to perish when there is ample food in the hive, the explanation usually given being that the bees must have clustered out of reach of their stores and died of starvation during cold weather. Sometimes the robbing of such hives by the other stocks in spring is the first sign that there is anything wrong.

A case has been brought to our notice of an apiary of fifteen "healthy" skeps in which the loss of the stocks seems to have been the first symptom noticed. Nine of the skeps were driven and the bees despatched to other parts. The remaining six were found dead during the winter. The fate of the driven bees is unknown, but it affords food for speculation (see page 111).

A correspondent thus describes two of the forms of the disease:—

> "The disease in my apiary of twenty-three hives seemed to have two forms, No. 1, in which the bees began by clustering on hive front and on fine days spreading out on ground unable to take wing and creeping back into the hive towards evening, but many of the older-looking left on the grass to chill and die, and so they dwindled thus for two or three months till only a few young bees and the queen remained.
>
> "Form No. 2, which began later (in November) by which I suddenly found eleven hives gone with their bees and queen in a heap on floor-boards, and little or no outward sign, and little or no soiling, and plenty of stores, with hives dry and snug."

From the various accounts sent in we learn that the loss of the power of flight mentioned in the first form may be gradual or may come on suddenly. Bees have been observed to collapse while on the wing. In other cases they have been noticed to fly heavily, or to progress by means of short flights of a few yards. Again, they have been described as apparently surprised at their inability to take wing, and are said to jump forward and tumble down when they leave the flight-board. But in other cases they seem well aware of their difficulty, and climb to the top of the hive as though seeking a better position for the start.

In several cases the first symptom noticed was the inability of the drones to fly. We do not think that the drones are often the first bees affected, but the workers may die while foraging, and their loss thus escapes the notice of the bee-keeper. This loss of honey-gatherers may account for such stocks killing off the drones very early in the year, which has also been mentioned as a first sign. And this slaughter in turn may explain the view held by some that the drones are not affected, since any drones remaining in the apiary would belong to healthy stocks. It is probable that a bee with the bowel heavily distended has some difficulty and very little inclination to use its sting, but the quiet behaviour of the bees is by no means universal. As the trouble is associated more or less with bad seasons and the absence of a honey-flow, robbing is bound to be a prominent feature in some apiaries where the disease is progressing. The vicious behaviour of bees at such times is well known to bee-keepers, and perhaps accounts for some of the statements made as to the excessive irritability of diseased stocks.

The queen is usually the last to die, but cases have also been described in which she died in the early stages of the disease, or the hive was found to be queenless. A young and vigorous queen may "swarm out," taking a few bees with her, as a result of the restriction of the brood nest and of diminished income owing to loss of flying bees. In other cases she may die of the disease, *Nosema* having been found in queens from diseased hives. Her loss may also be due to another circumstance.

A sour smell has been noticed in some affected hives, and a yellow coloration of the brood has also been detected. In such cases it is very probable that the stock is also affected with one of the little-known brood diseases, characterised by a yellow colour of the dying larvæ (which, however, are removed by the adult bees), a sour smell, and frequently by the early loss of the queen. This explanation of multiple infection is probably the true one in such cases as that described by *Brighton* (1911), where the queen was the only survivor in a hive affected with foul brood. A disease of the adult bees, such as *Nosema* in connection with the common form of foul brood, would account for the phenomenon.

The outstanding wing appears to be a sign of debility, and for that reason is more frequently seen in the bees of diseased stocks. It may be seen in the bees of normal stocks, and is not always detected in those belonging to diseased stocks. It has been claimed that it is the first sign that a stock is affected, but *Edwards* (1910), who has paid much attention to this feature in studying the Buckinghamshire epidemic, concludes that it is valueless for diagnostic purposes.

Nothing definite can be stated as to the length of time that an affected stock may live. Sometimes death may take place a week after the first symptoms are noticed; on the other hand cases are recorded of the affected stocks living for months, and even for years. A case of paralysis which had been intermittent for five years has been mentioned previously (p. 14). So much depends on dose, on the natural resistance of the bee, and on the virulence of the organism, and these in turn are so much affected by many circumstances, that great variations in the duration of the disease necessarily occur. Variation in the severity of the disease is well shown in the following account written in July, 1911.

> "Had disease previous year about one mile away, but then the loss was two quarts* a day; now the loss is twelve to two hundred. This has been going on since March in some hives around here. One that is so affected has swarmed twice, while others have not gathered one ounce of honey. There are plenty of bees, and they crawl about all over the place. Without doubt it is some disease similar to the Isle of Wight, but that disease took all off in about a week, while these have been going on for months. . . . Neither do they cluster at night, but die in ones and twos."

A general abatement of the disease may possibly be due to the different weather conditions in the district. The summer of 1910 was wet and cold, and the disease was much in evidence; that of 1911 was fine and warm, and comparatively few cases were reported. In the latter year, while some affected stocks gave a surplus, others were starving in the autumn.

The elimination of the more susceptible stocks must have an influence on subsequent epidemics.

The incubation period or time that must elapse between the date of infection and the appearance of disease is influenced by so many conditions that no rule can be laid down. The rapid progress of the disease through an apiary in a few weeks does not necessarily afford conclusive evidence of a very short period of incubation. Many, if not all, of the hives may have been infected before any signs of the disease appeared, the almost simultaneous manifestation of symptoms being due to the action of similar conditions on all the stocks. The disease was first noticed in the Isle of Wight and in Cornwall in 1904. Intercommunication being improbable, we are inclined to attribute the simultaneous appearances of the outbreaks to similarity of weather conditions. The three simultaneous outbreaks in Hertfordshire in 1907 (*H.S.*, 1908) may be explained in the same way, as well as two outbreaks which occurred within a few days of one another in a northern county, although the affected districts were about twenty miles apart. In the latter case, which occurred in 1911, no known sources of infection had been imported into the district for several months previously. We think it very probable that the death of the affected bees while foraging often masks both the early stages of the disease and its progress during fine weather. We look upon this as the possible explanation of the heavy losses noticed when bees are working particular flowers. A long list which would include most honey-yielding plants might be made of sources which have been recorded as poisonous, or in some way injurious to bees. An opportunity of examining hive bees that have died in large numbers under lime-trees has not yet occurred, though the phenomenon has attracted considerable attention from time to time without satisfactory explanations having been given. A number of humble-bees which were picked up last summer under an acacia were found to be heavily infected with a species of *Nosema* (see p. 131).

---

* About eight thousand.

Last year in an apiary of twelve stocks on the Isle of Wight, eleven were strong in August, and had done well in the supers. The twelfth stock had yielded no profit, and on examination it was found that there were several frames of brood, and not enough bees to cover them. No honey was present, and the larger wax-moth was making rapid progress among the combs. The stock was promptly sulphured, and the contents of the hive were burnt. Fortunately but little else can be done with a stock badly affected with wax-moth, but we think it well to put on record our opinion that wax-moth in a stock of living bees is more likely to be a result than a cause of its degeneration. In this case the loss of the flying bees was probably due to *Nosema.*

When the losses are not numerous, or when the death of the bee occurs comparatively late in its life as a forager, the risk to survivors is much lessened by the fact that death often takes place away from the hive. A lack of swarms or a slightly lessened surplus may be the only consequences of this form of the disease during the summer. But, as we have shown, such stocks may die suddenly during the winter. We think, therefore, that the bee-keeper should look upon the death of a stock which has ample bees and stores as a highly suspicious circumstance. The hive and contents should be treated as though it were known that *Nosema* had caused the disaster. Apiaries in which the winter and spring losses usually amount to between 20 and 30 per cent. of the total number of stocks, and in which swarming never occurs under any circumstances, are kept going by the yearly importation of swarms and driven bees. Such apiaries are probably the endemic centres from which the disease spreads, when, owing to conditions of which we are not yet fully cognisant, it assumes the epidemic form.

An analysis of the reports, received from bee-keepers in a relatively small area (Hampshire) during the years 1909 and 1910, shows the variations in the symptoms exhibited in that area during those years. It must be remembered that these reports have been made by persons of very different degrees of intelligence and skill, and that many of the symptoms detailed are not mentioned by several of the observers, so that there are no means of ascertaining whether or no any of the symptoms which they omit were present. In the accompanying analysis only those symptoms are dealt with which are actually mentioned as being present or absent by the bee-keepers who make the reports.

Analysis of the Reports from Bee-keepers in the County of Hants in the years 1909 *and* 1910 *as to the Symptoms shown by Affected Bees. Sixty-one reports were received.*

No. of Report.	Symptoms.	Present.	Absent.
1	Bees disinclined to work	13	—
2	,, ,, ,, sting	1	—
3	Constipation	1	—
4	Dysentery	14	—
5	Abdomens distended	7	—
6	Wings dislocated	9	2
7	Bees fell off alighting board	38	—
8	Gather in clusters on ground or crawl about	33	—
9	Foragers affected first	11	1
10	Young bees affected	1	—
11	Drones ,,	2	2
12	Queen ,,	1	4
13	Stock dwindles, but no dead bees seen	4	—
14	Bees die in hive	8	1
15	,, ,, outside	7	—
16	,, appear paralysed	1	—
--	Brood affected	0	7

From the foregoing pages it may be seen that the most important symptom of *Nosema* infection is the death of a large number of bees, either within or without the hive. This is in complete agreement with the views of Zander, who discovered the parasite on the Continent and described the disease, and of *Nussbaumer* (1912), who has recently described the disease in Switzerland, and who says in regard to it: "*Nosema* is often difficult to detect. A fairly sure symptom is the high mortality among the bees, and a correspondingly slow development, or in bad cases a diminution of the stock, in spite of good breeding conditions and plenty of food. The disease is absolutely impossible to diagnose with certainty without the microscope." In the struggle to combat the disease the bee-keeper can only watch for unsatisfactory stocks, and relentlessly weed out the ne'er-do-wells. Stocks that are starving in the autumn, unless there is some satisfactory reason for it, should be sulphured rather than fed. Hives when their occupants have succumbed to wax-moth, starvation, queenlessness, &c., should be treated as infected, in case the disease was the cause of the first decline. It is doubtful whether much good arises from the uniting of dwindlers in the spring, and we think it would be safer to sulphur them and disinfect the hives. To wait until the crawling symptom is apparent is to court disaster. It is possible that this symptom only occurs when the dose of infection is heavy, and by the time it does appear the whole apiary may be infected.

The management of an apiary in which disease has already appeared is dealt with in Section X.

SECTION IV.

THE RELATION OF *NOSEMA APIS* TO THE ISLE OF WIGHT DISEASE.

By G. S. GRAHAM SMITH, M.D., H. B. FANTHAM, D.Sc., B.A., and ANNIE PORTER, D.Sc.

Fantham and Porter first observed a Protozoön, *Nosema apis*, in the digestive tract of bees obtained from the Isle of Wight in 1906. The number of bees received was very small, and the research was in consequence restricted, but they were able to show by experiment (p. 79) that the parasite was pathogenic for bees. In 1907 they again found this parasite in a small number of bees obtained from the island. In subsequent years (1908–10) they obtained specimens of bees showing symptoms of the Isle of Wight disease from various districts (Hampshire, Surrey, Middlesex, Cambridgeshire, and Hertfordshire), and found *Nosema apis* in specimens from all of them. By further feeding experiments they showed that the parasite produced a fatal disease, not only in bees, but in wasps (p. 130).

On April 4th, 1911, Fantham and Porter exhibited microscopic preparations of *Nosema apis*, together with diseased bees and infected combs, at a meeting of the Zoological Society of London. They stated that in their opinion, *Nosema apis*, as shown by observation and experiment, was the causative agent of a fatal disease of bees, and emphasised the fact that it had been found in bees obtained from the Isle of Wight. In the meantime, Zander had found *Nosema apis* in diseased bees in Bavaria.

Fantham and Porter, in the course of the investigations just mentioned, observed several other species of Protozoa, namely, various species of gregarines, a flagellate apparently belonging to the genus Crithidia, a new Amoeba (*Entamoeba apis*), and a spirochæte in small numbers in the intestinal tracts of a few diseased and normal bees (see Section XIII).

Owing to the apparent failure of Malden and other observers to establish any bacterium as the cause of the disease, it was decided to pay special attention to the protozoal parasites (more particularly to *Nosema apis*), which occur mainly in the intestinal tracts of diseased bees.

For routine examinations bees were killed with chloroform, and the alimentary tracts and their appendages dissected out. Fortunately, at an early stage in the investigations, bees very heavily infected with the spore stage of *Nosema apis,* and others less heavily infected, were procured, and we were therefore able to compare the appearances seen in various stages of infection.

Very marked anatomical changes, visible to the naked eye, were seen only in specimens heavily infected with spores. In such cases the walls of the chyle stomach had a white, glistening appearance, and were very easily ruptured, a white, milky fluid being exuded. When examined under the microscope, the fluid was found to contain very large numbers of spores (Plate I, Fig. 1). Zander has described and figured the same condition. In less marked infections the alimentary canal appeared normal, but was unusually fragile, whilst in slight infections and in the earlier stages of infection no constant anatomical changes were noticed.

For microscopical examinations small portions from different parts of the alimentary canal were teased out in a drop of water, and mounted under a cover-glass. When the spores of *Nosema apis* occur, they can be easily distinguished as oval, highly refractile bodies, 2 to 4 μ in diameter, and 4 to 6 μ in length. Frequently they are found lying between the cells in preparations made from heavily infected bees. In the slightly earlier stages some of the cells of the gut wall, especially those of the chyle stomach, are distended with them. When mature, these intracellular forms are similar to the extracellular forms, but previous to becoming mature they exhibit a well-marked, oval, less refractile area at one end. By suitable treatment the extracellular mature spores sometimes may be made to extrude polar filaments. In yet earlier stages colonies of pansporoblasts may be seen within the cells as rounded, oval bodies, each colony containing numerous spores. In the growing and multiplicative stages which precede the formation of spores, the parasites usually occur as small, oval, granular, intracellular bodies, surrounded by well-marked, broad, oval, or round clear zones (Plate I, Figs. 3 and 4). The various changes which the parasites undergo during development are described in Section V, and consequently a detailed account of these stages is unnecessary here.

Fixed and stained preparations have not been extensively made use of for diagnostic purposes, as the parasites stain poorly, and can be more readily distinguished in fresh preparations.

Specimens from stocks, apparently suffering from Isle of Wight disease, were first received in March, 1911, and since that time specimens have been received from various districts throughout the year. We endeavoured as far as possible to examine only bees

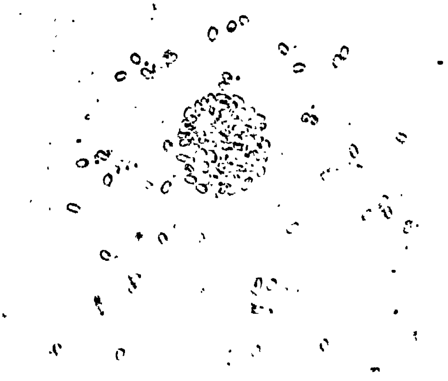


Fig I

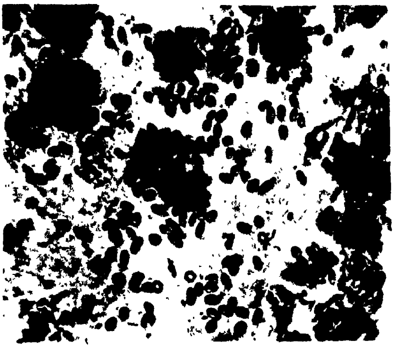


Fig.2.

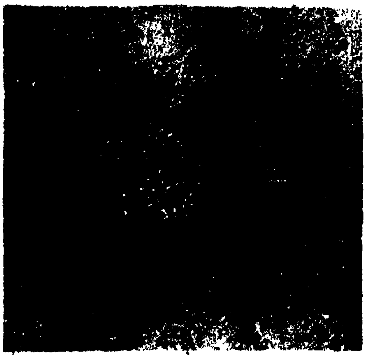


Fig 3.

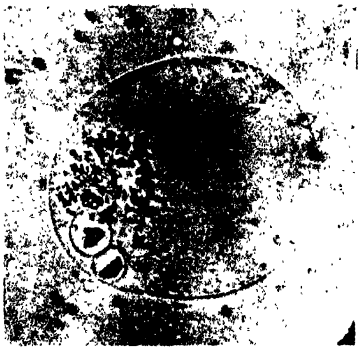


Fig. 4

Plate I.

Fig. 1—Photograph of fresh unstained smear preparation from the chyle stomach of a heavily infected bee, showing many spores of *Nosema apis*. In the centre a cell crowded with spores. (×500.)

Fig. 2—Photograph of fresh unstained smear of heavily infected fæces. The large dark masses are partially digested pollen grains with many *Nosema* spores between them. (×500.)

Fig. 3—Photograph of a detached cell of the chyle stomach infected with a young form of *Nosema apis*. (Fresh preparation, ×500.)

Fig. 4—Photograph of a detached cell of the chyle stomach, showing multiple infection with three young forms of *Nosema apis*. (Fresh preparation, ×500.)

which reached us alive, and which showed the symptoms of the disease. Often, however, only dead bees were obtainable. Sometimes the bees had died in transit, but occasionally bees which had been dead for some time were sent.

Fungi rapidly develop in the alimentary canal of the bee after death, and destroy the epithelium, often making the search for the young stages of *Nosema apis* unsatisfactory or impossible.

Whenever possible, specimens from each source were examined by at least two, or all three, of us.

The results of these examinations are recorded in Table I. (p. 42).

This table shows the results of examinations of specimens from sixty-six apiaries, situated in various parts of Great Britain. From some of these apiaries specimens from different stocks were examined at various times. *Nosema apis* was not found in specimens from thirteen apiaries. From three of these (Nos. 22, 42, 58), however, only dead bees were received, and consequently satisfactory examinations could not be made. In considering the results, no importance can be attached to these three examinations.

The results of the examinations of specimens from the remaining sixty-three apiaries may be briefly summarised in the following way: The spores of *Nosema apis* were found, in larger or smaller numbers, in specimens from twenty-nine apiaries; young stages of *Nosema apis*, but no spores, in specimens from twenty-four apiaries. The examination of specimens from the other ten apiaries yielded five doubtful and five negative results.

The results were recorded as doubtful when only small numbers of bodies resembling very young intracellular stages were noticed, and the larger intracellular forms were absent. Though the objects seen suggested a very early stage of infection, it was considered undesirable in the present state of our knowledge to give a positive diagnosis. The histories relating to the five stocks which showed doubtful forms are as follows:— No. 30. The bees were found crawling in front of the hive, but seemed short of stores. No. 32. The bees showed typical symptoms, and *Nosema apis* was found in another stock (No. 44) close by. No. 45. The stock only showed slight symptoms, but was situated near an infected stock. No. 55. The bees arrived dead. No. 57. The stock showed marked symptoms, but these had only appeared a day or two previously.

The histories of the stocks which gave negative results are as follows:—In Nos. 1 and 2 the symptoms were slight and atypical, and No. 2 seems to have recovered. No. 41. The symptoms were

TABLE I.

The Results of Examinations of Diseased Stocks.

No.	Date.	Locality.	Result.	Remarks.
1	22 April, 1911	Greenhythe	*Nosema* not found (G-S, P, F).	The whole stock was sent to Cambridge and kept in a greenhouse. The stores were scanty and the stock was apparently suffering from starvation. It ultimately died out on June 19th. Repeated examinations failed to show *Nosema* in any stage. Breeding did not occur.
2	18 April, 1911	Thetford	*Nosema* not found (G-S, P).	Dead bees were found outside several of the hives. "All this passed off and in the end, 1265 lb. of honey were obtained from 19 hives, of which the one which had so many dead yielded as much, or even more, honey than the rest. A neighbouring apiary did very well.
3	30 April, 1911	Meldreth	Young stages numerous, 30th April (G-S, P). Also on 9th, 11th, and 12th May (G-S, P, F).	This stock had suffered from the symptoms of the Isle of Wight disease and large numbers of bees had died. The remainder of the stock was sent to Cambridge on May 8th, and was kept in confinement for observation. No eggs or unsealed brood present. Large numbers died daily. Frequent examinations of the workers showed young stages, but no spores. Spores were, however, found in some of the drones. The stock died out in a few weeks.
4	26 April, 1911	Bexley	Both spores and young stages found (G-S, P, F). Queen dead, but contained spores (G-S).	One stock had already died and the bees examined were the remains of another stock. Three other stocks in the apiary were affected.
5	28 April, 1911	Royston	Few young stages (G-S). Young stages, spores in one bee (P).	These bees came from a large apiary in which a large number of stocks had succumbed with the symptoms of the Isle of Wight disease.
6	26 April, 1911	Renfrewshire ...	Very severe infection. Spores very numerous.	In this apiary the disease first appeared in a stock obtained from Middlesex. It appeared to recover, but after some months the symptoms again appeared, and the stock died. The bees examined were from an adjoining hive.
6*a*	16 May, 1911	,, ...	Severe infection, spores numerous (G-S). Spores in 50% (F).	From a hive adjoining the one from which sample 6 was obtained. It had only showed symptoms for 2 or 3 days. This stock was sent to Cambridge and was put in confinement (Stock VIII, p. 92) and did fairly well for a month. Afterwards it gradually dwindled and died on Sept 29th. After a few weeks spores could only be found with difficulty (G-S).
6*b*	16 May, 1911	,, ...	Spores in 50% (P). Spores in some (G-S, F).	From a hive adjoining the above.

7	9 May, 1911	Ormskirk	No spores found (G-S). Spores in one out of three (P).	The majority of bees in this hive, including the queen, had died, with the symptoms of the Isle of Wight disease. Three out of the four other hives in this apiary were affected.
8a	9 May, 1911	Elgin	Very severe infection. Spores very numerous (G-S).	The specimens sent were picked up in front of a hive. This colony, before it showed symptoms in the middle of March, was very strong. The owner, during 25 years of bee-keeping, had never previously seen trouble of this kind. In June, 1910, he received several swarms from Hampshire, two of which showed symptoms within a fortnight and ultimately died. Shortly afterwards two other stocks developed the symptoms, and afterwards the disease spread to others.
8b	23 Feb., 1912	—	All infected, some severely, with spores (G-S, P).	The specimens were crawling bees from this apiary.
9	4 May, 1911	Brewood	Spores in 33% (G-S). Few spores in some (F). Young stages (P).	Bees dying very rapidly.
10	8 May, 1911	Basingstoke	Spores in 12% (G-S). Spores present (P).	In this apiary the disease spread from hive to hive. At the time of examination, several stocks had been lost.
11	9 May, 1911	Whittlesford ...	Young stages (P). Spores in a few (F).	These bees had from time to time shown symptoms of the disease, but in the intervals appeared to be perfectly healthy.
12	10 May, 1911	Fowey	Spores in 20% (G-S). Young stages (P).	Specimens from two stocks were sent. In this apiary 20 out of 30 stocks had died during the winter and spring.
13	9 May, 1911	Salisbury	No spores found (G-S, F). Very few spores in some (P).	Specimens sent were found crawling in front of the hive. Arrived dead.
13*a*	22 June, 1911	,, ...	Many young stages (G-S, P).	Specimens from the same apiary from a strong swarm, which in 3 weeks showed symptoms and rapidly dwindled.
14	19 May, 1911	Helston	Few spores in some, young stages numerous (G-S). Spores in 33% (P). Young stages (F).	Specimens were from a hive that had almost died out. A neighbouring hive had perished a short time previously.
15	29 May, 1911	Hallingbury... ...	Spores in a drone, very few in workers (G-S). Very few spores (P).	In this apiary the stock, which was originally affected, had apparently recovered. The bees examined were from other stocks which had apparently contracted the disease.
16	1 June, 1911	Farnham	Spores in 10% (G-S). Spores not found (P, F).	A parent stock died in the winter of 1910. The bees examined came from a swarm which first showed signs of the disease in April, 1911. At the time of examination several hundreds of bees were alive in the hive.
16*a*	7 June, 1911	,, ...	Very few spores in one out of 9 (P). Few young stages (G-S).	Further specimens obtained on June 17th, when the symptoms had disappeared.

TABLE I (*continued*).

No.	Date.	Locality.	Result.	Remarks.
17*a*	1 June, 1911	St. Erth	Young stages (F, P).	Specimens from two stocks in the same apiary, both showing symptoms.
17*b*		,, ...	,, ,, (F, P).	
18	7 June, 1911	Farnham	Few spores in most specimens (F). Young stages (P).	Bees from a wild swarm which took possession of an old infected hive in which the bees had died in 1910. At the time of examination they were said "to be exhibiting the initial symptoms of the Isle of Wight disease."
19	14 June, 1911	Rickmansworth ...	Spores numerous in 25% (G-S). Spores present (P). Some spores in 16% (F).	The "bees were from a stray swarm which had hived themselves in an old hive containing honey and comb left by a stock that died last winter." "Dead and dying bees were found all over the garden." Nine stocks in this apiary had died of Isle of Wight disease. By July 15th the stock appeared to have recovered and was working well. On September 26th the stock seemed healthy, but 3 out of 4 specimens examined showed spores.
20	15 June, 1911	Egham	Some young stages (G-S). One spore in a drone (P). Few spores in a drone (F).	A fortnight previous to examination this stock had been pronounced quite healthy by an expert. Bees were numerous and a large quantity of honey had been collected. "Suddenly they became listless and inactive and died by hundreds on the ground round the hive." Other specimens examined on June 23rd showed young stages, but no spores (G-S).
21	16 June, 1911	Winchmore Hill..	No spores, but some young stages (G-S).	From a solitary hive which had never been interfered with, situated about a quarter of a mile from other stocks which had died. Symptoms appeared about the middle of May, crawling and dying bees being found near the hive in hundreds.
22	17 June, 1911	Bramley	All dead. *Nosema* not found (G-S, P).	From "a swarm which took possession of an empty hive where the bees had died last summer." The bees were dead on arrival.
23	17 June, 1911	Shepreth	Young stages, very few (G-S). No spores found (P).	Fifty hives in this apiary. On June 5th some bees were noticed crawling in front of one hive. This stock was destroyed. On June 12th some crawling bees were noticed in front of another hive. The bees examined were from this stock.
24	21 June, 1911	Southampton ...	Young stages but no spores (G-S, P, F).	The disease was first noticed on June 4th. Large numbers were dying on June 21st. The swarm was a stray one of unknown origin.
25	29 June, 1911	Redhill...	Young stages numerous, no spores (G-S, P, F).	The swarm affected, but not the parent stock. Dead and dying bees were very numerous round the hive and the grass was soiled with yellow droppings, but there were no signs of dysentery in the hive. "Three stocks close by seem to be affected."

26	29 June, 1911	Totland Bay	Young stages numerous, no spores (G-S, P, F).	This stock had been healthy from 1909 till May 15th, 1911, when it first showed signs of the disease. By June 29th a large proportion of the bees had died.
27	29 June, 1911	Uxbridge	Young stages numerous, no spores (G-S, P, F).	From a stock "showing suspicious symptoms."
28	29 June, 1911	Freshwater	Young stages (G-S). Young stages in most, in one several spores (P). Young stages and a few spores (F).	These bees were from a strong swarm which had been captured a month previously. At the time of examination the stock was badly diseased.
29	29 June, 1911	Totland Bay ...	Young stages only (G-S). Only dead bees examined, no spores found (P, F).	This stock was obtained in Hampshire. At the time of examination large numbers of bees were crawling and dying in front of the hive.
30	29 June, 1911	Freshwater	Some doubtful, young stages (G-S, P, F).	"Bees crawling about, but seem short of stores."
31	30 June, 1911	Redhill...	Young stages in some (G-S). Young stages and a few spores (P).	
32	3 July, 1911	Haverstock Hill ...	Some doubtful young stages (G-S, P).	"This stock was a most flourishing one early in the season, and threw a large swarm on May 23rd, but very soon after the loss of bees began." "For weeks there has been a continuous mortality, the bees crawling about the ground and gathering in little clusters on weeds and blades of grass."
33	4 July, 1911	Tonbridge	Young stages common (G-S, P).	
34	4 July, 1911	Newmarket	Young stages common (G-S, P).	This stock had shown symptoms of Isle of Wight disease for some time. The greatest mortality occurred about June 22nd. The stock was sent to Cambridge and kept in confinement, surviving till December 18th. No spores were found, but young stages were constantly met with.
35	4 July, 1911	Cheshunt	Young stages numerous (G-S, P). Queen and drones showed young stages (G-S).	The symptoms were first noticed about the middle of May in one colony. Others became affected about 14 days later. At the time of examination none of the colonies had completely died out, but some were very weak.
36	8 July, 1911	Farnham	Bees dead. *Nosema* not found (G.S). In one specimen, 2 spores (P).	This stock had shown suspicious symptoms a short time previously, but at the time of examination appeared to be quite healthy.
37	13 July, 1911	Uxbridge	Young stages in a few (G-S, P).	Bees diseased, but no details given.
38	18 July, 1911	Milnathort	Some doubtful young stages (G-S, F). Some young stages, and in one a few spores (P).	" " "

TABLE I (*continued*).

No.	Date.	Locality.	Result.	Remarks.
39	20 July, 1911	Ashbourne	Young stages in 15% (G-S). Dead bees only examined, few spores in one (P).	"The affected bees fall to the ground in front of the hive, crawl about for a short time as if unable to fly and then die."
40	22 July, 1911	Farningham... ...	*Nosema* not found (G-S, F). Spores in a small proportion (P).	"The bees drop from the hive to the ground and seem unable to get back. This has been going on for 10 days. The stock is now almost dead." (All bees dead on arrival.)
41	22 July, 1911	Eastbourne	*Nosema* not found (G-S, P).	"Hive and weeds about thick with crawling bees." "No Isle of Wight disease in the neighbourhood." Two sets were examined at different times.
42	25 July, 1911	High Wycombe ...	*Nosema* not found (G-S, P).	17 out of 19 stocks in this apiary seemed to be affected. The bees sent were picked up off the ground. All arrived dead.
43	26 July, 1911	Inverleithim ...	Young stages common (G-S, P, F).	"All stocks affected. The bees are crawling about in hundreds."
44	1 Aug., 1911	Haverstock Hill ...	Young stages in small numbers (G-S).	"From a strong swarm which issued 2 or three weeks ago. Large numbers have been crawling on the ground. The queen has laid freely, but the bees are dying off rapidly."
45	3 Aug., 1911	Aberlour	Some doubtful young stages (G-S).	A stock obtained from the south of England dwindled and died in the spring, and perhaps the other stocks robbed it. The specimens sent were from the other stocks, which only showed very slight symptoms.
46	25 Aug., 1911	Isle of Wight ...	Few young stages only (G-S). Queen negative (G-S).	From a "hive which has shown disease all the summer."
47	13 Sept., 1911	,, ,, ...	Few young stages in workers and queen (G-S).	From "a stock suffering from Isle of Wight disease."
48	16 Sept., 1911	Noton	Young stages, no spores (G-S).	This stock had shown symptoms earlier in the year and then apparently recovered. At the time of examination the symptoms had reappeared.
49	16 Sept., 1911	Ash	*Nosema* not found (G-S).	In July this stock appeared to be badly affected, but at the time of examination was strong and apparently healthy.
50	24 Sept., 1911	Winchester	Young stages only (G-S).	" From a "suspected stock."
51	24 Sept., 1911	Weston-super-Mare	*Nosema* not found (G-S).	" These bees have all the symptoms of the Isle of Wight disease, . . . but they are cider making where I keep them and I think they get intoxicated."
52	26 Sept., 1911	Chilbolton	Few spores in 75% (G-S).	Specimens from a stock which had been robbing a small but apparently healthy stock in another apiary.

53	4 Oct., 1911	Thorley	Few young stages (G-S).	"Bees in this hive have apparently not been doing well for 2 or 3 years."
54*a*	10 Oct., 1911	Stornoway	Many young stages (G-S).	The disease first appeared in this district in a stock which was imported in September, 1910. This stock was destroyed in January, 1911. The two stocks from which the specimens were examined first showed symptoms in September, 1911.
54*b*			,, ,, (G-S).	
55	12 Oct., 1911	St. Asaph	A few doubtful young stages (G-S).	The bees sent for examination were found crawling on the ground. All arrived dead.
56	13 Oct., 1911	Blair Athol	Some young stages (G-S).	
57	13 Oct., 1911	Catford...	Few doubtful young stages (G-S).	The specimens were from two stocks which stood near one which had just previously been destroyed, as it was thought to be suffering from Isle of Wight disease. "The symptoms are very marked in them and the ground by the hives is covered with dead and dying bees." The symptoms had only appeared a day or two previous to examination.
58	31 Oct., 1911	Langley	No spores (G-S).	The stock was a good swarm in June and did well. About the beginning of August they started dwindling and have now completely died out." Only dead bees examined.
59	3 Nov., 1911	Whitwell, I.O.W..	Some young stages (G-S).	Stock said to be diseased, but no details given. Bees arrived dead.
60	17 Nov., 1911	Totton	,, ,, (G-S).	,, ,, ,, ,, ,, ,,
61	17 Nov., 1911	High Wycombe ...	Young stages numerous, no spores (G-S).	,, ,, ,, ,, ,, alive.
62	29 Nov., 1911	—	Spores in some (G-S). Spores in 60% (P).	
63	26 Jan., 1912	Cuckfield	In one bee a few spores found (P).	From a stock which had been hived in an old hive after disinfection and which, after becoming listless, had died. The bees received had been dead some time.
64	31 Jan., 1912	Bassingbourn ...	Spores found in some of the bees (P).	Specimens from a stock which had almost died out. It first showed symptoms in the early months of 1911, but recovered towards the end of May and did well for some months.
65	31 Jan., 1912	Binfield	11 spores ound in an emulsion made from 20 bees (P).	Specimens from a colony which had died some time previously.
66	15 Feb., 1912	—	Young forms and few spores (F, P).	"Few bees only alive. Numbers lying dead about the hive. No dysentery."

marked, though no cases of Isle of Wight disease were known to have occurred in the neighbourhood. No. 49. The stock had been apparently badly infected three months previously, but had recovered, and at the time of examination seemed to be healthy. No. 51. Though the stock showed symptoms resembling those seen in cases of Isle of Wight disease, the owner was convinced that the bees were intoxicated with cider.

Even assuming that the disease was present in all the ten apiaries just mentioned, these examinations afforded evidence of the presence of *Nosema apis* in fifty-three out of sixty-three (84 per cent.) apiaries, in which the symptoms of the disease were observed.

Taking into consideration the following facts, viz., that *Nosema apis* is met with in 84 per cent. of stocks reputed to be suffering from the disease, that infection experiments have proved that the parasite produces a fatal disease in bees, that very marked destruction of the tissues of the alimentary tract is found in severely infected specimens, whether the condition has been produced experimentally or naturally, and that in less marked infections a high proportion of the cells lining the alimentary tract are invaded by the parasites and injured, the writers consider themselves justified in taking the view that *Nosema apis* is the causative agent in most outbreaks of disease in which the Isle of Wight symptoms are present.

Undoubtedly the most certain evidence of the presence of *Nosema apis* is afforded by finding the characteristic spores. Unfortunately these are not always present, and consequently the diagnosis may have to depend on the finding of the young stages of the parasite in the cells of the gut epithelium. Our observations show that during the warmer months the parasites often do not reach the spore stage, but seem to kill the affected bees before this stage is reached.

Table II on p. 49 summarises the evidence which has been obtained on this point.

It may be seen from this table that spores were present in greater or lesser numbers in seventeen out of twenty (85 per cent.) of the apparently diseased stocks examined between April 22nd and June 15th. In eight (40 per cent.) they were present in large numbers.

Samples from forty-one apiaries were examined between June 16th and November 17th, but spores were only found in seven (17 per cent.), usually in very small numbers. During this period, however, young stages only were encountered in twenty-three (56 per cent.). During November, 1911, and January and February, 1912, specimens from five apiaries were examined, and all contained spores.

TABLE II.

Date.	Number.	Spores present.	Young stages found.	Doubtful young stages.	Remarks.
1911					
April 22	1	o	o	o	...
,, 18	2	o	o	o	...
,, 30	3	+ (in drones)	++	...	...
,, 26	4	++	++	...	...
,, 28	5	+ (very few)	++	...	...
,, 26	6	+++	+	...	...
May 9	7	+ (very few)	...	...	...
,, 9	8	+++	+	...	...
,, 4	9	++	+	...	...
,, 8	10	++	+	...	...
,, 9	11	+ (very few)	++	...	...
,, 10	12	+	++	...	...
,, 9	13	+ (very few)	++	...	...
,, 19	14	+	+++	...	...
,, 29	15	+ (very few)	++	...	...
June 1	16	+ (few)	+	...	...
,, 1	17	o	+++	...	...
,, 7	18	+ (few)	++	...	...
,, 14	19	++	...	...	...
,, 15	20	+ (in drones)	++	...	...
,, 16	21	o	++	...	...
,, 17	22	o	o	o	All dead.
,, 17	23	o	+	...	...
,, 21	24	o	++	...	...
,, 29	25	o	+++	...	...
,, 29	26	o	+++	...	...
,, 29	27	o	+++	...	...
,, 29	28	+ (few)	+++	...	...
,, 29	29	o	++	...	...
,, 29	30	o	o	+	...
,, 30	31	+ (few)	++	...	...
July 3	32	o	o	+	...
,, 4	33	o	+++	...	...
,, 4	34	o	+++	...	...
,, 4	35	o	+++	...	...
,, 8	36	+ (very few)	o	...	All dead.
,, 13	37	o	+	...	...
,, 18	38	+ (very few)	+	...	...
,, 20	39	+ (very few)	++	...	...
,, 22	40	+ (few)	+	...	...
,, 22	41	o	o	o	...
,, 25	42	o	o	o	All dead.
,, 26	43	o	+++	...	...
Aug. 1	44	o	+	...	...
,, 3	45	o	o	+	...
,, 25	46	o	+	...	...
Sept. 13	47	o	+	...	...
,, 16	48	o	++	...	...
,, 16	49	o	o	o	Healthy when examined.
,, 24	50	o	+	...	...
,, 24	51	o	o	o	Intoxicated.
,, 26	52	++	+	...	...
Oct. 4	53	o	+	...	...
,, 10	54	o	+++	...	...
,, 12	55	o	o	+	All dead.
,, 13	56	o	+	...	...
,, 13	57	o	o	+	...
,, 31	58	o	o	o	All dead.
Nov. 3	59	o	++	...	All dead.
,, 17	60	o	++	...	All dead.
,, 17	61	o	+++	...	All dead.
,, 29	62	++	+	...	...
1912					
Jan. 26	63	+ (very few)	...	...	All dead.
,, 31	64	+	+	...	...
,, 31	65	+	+	...	...
Feb. 15	66	+ (few)	+	...	...

+ = parasites present in small numbers
++ = ,, ,, larger ,,
+++ = ,, ,, very large numbers

We may therefore conclude that the spore stage is more commonly reached during the colder months and the spring.

Experiments have conclusively proved that the spores are capable of producing a fatal disease in healthy bees, but no such experiments have been undertaken with young stages of the parasite only, and up to the present we have no evidence that the young stages are capable of causing infection when fed to healthy bees, although bees in which the young stages only are found die in large numbers.

As controls to the specimens from infected stocks, specimens from twenty-two apiaries, in which no symptoms of the disease had appeared, were examined. In twenty of these samples no evidence of the presence of *Nosema apis* (in any stage) was obtained. In one, a few bodies slightly resembling young stages were seen. Further specimens from this stock were obtained, and a large number examined, but neither spores nor certain young stages were discovered. We are therefore inclined to think that this hive was free from infection.

Spores in small numbers were found, however, in specimens from several stocks in one apiary in Scotland. No symptoms of the disease had previously been noticed, and none have appeared since. The history of this apiary is given on p. 91. We must regard such stocks as partially immune to the strain of *Nosema* with which they are affected, although possibly not to other or more virulent strains. At the same time, it is very probable that they are capable of infecting non-immune stocks if the opportunity occurs.

It seems to the writers extremely probable that many of the stocks which recover become partially immune, at any rate for a time, to the effects of the parasite, but still continue to harbour it, and are consequently a source of danger to the non-infected stocks in the neighbourhood. Fantham and Porter called attention to this type of "parasite carrier" in their communication to the Zoological Society of London (April 4th, 1911).

An instance of immunity to the same type of parasite may be quoted in this connection. It has been recorded by some investigators (Bolle, cited by Maassen) that Japanese silkworms and their eggs are frequently infected with *Nosema bombycis,* the parasite which causes the very destructive disease known as pébrine in silkworms, and yet they do not suffer from the disease. It is therefore thought that the silkworms of Japan have a greater natural immunity against *N. bombycis* than have European silkworms.

On the Continent several observers, especially Zander and Maassen, have recently issued reports on the prevalence and pathogenicity of *Nosema apis.*

Zander in Bavaria made a very careful study of bees suffering from "infectious dysentery," and showed that *Nosema apis* was the infecting agent. He first discovered the parasite in June, 1907, at Petersdorf, near Erlangen, and gave it the name of *Nosema apis*. Further references to his work will be found in Section VII. He is careful to point out that dysentery is not a necessary feature of *Nosema* infection, and states that the essential symptom of the disease is the sudden and extensive mortality among the bees inside and outside the hive. He believes that in a longer or shorter period every infected bee dies of the disease.

Maassen and *Nithack* (1910) state that bee-keepers take far less notice of disease of adult bees than of disease of the brood, and that if the prevalence of the disease were judged only by the specimens sent to the institute for examination, dysentery due to *Nosema apis* would be considered relatively rare in Germany. Their researches on adult bees, however, proved that *Nosema apis* was very widely distributed.

Maassen (1911), as the result of further observations, has come to the conclusion that *Nosema apis* can be found in most stocks in Germany, though different apiaries show very decided variations in the degree of their infection, in the majority of apiaries the number of infected bees being very slight. These affected bees he calls "parasite carriers." At the same time, he says that by prolonged search a certain number of bees can be found even in slightly affected stocks which contain the enormous number of spores characteristic of the acute form of the disease—dysentery. He seems to think that though the parasites are undoubtedly pathogenic, the disease only makes its appearance when the stocks are weakened by unfavourable conditions.

Nussbaumer (1912) says that *Nosema* is widely spread in Switzerland, and that the disease produced by it is at its worst in the spring.

Hein (8, viii., 1911), in his address to the Conference of German, Austrian, and Hungarian bee-keepers, admitted that bees containing *Nosema* were diseased, but pointed out that many of them did not suffer from dysentery and that a large number of colonies, the bees of which were found to contain the protozoön, passed the winter very well and showed no signs of dysentery or May-pest. He therefore thinks that *Nosema* is not so dangerous as Zander supposes it to be, and doubts if it really has anything to do with causing dysentery.

Similar opinions are expressed by some of the Australian investigators. *Brown* (15, vi., 1911) says that "*Nosema* has nothing to do with it. The *Nosema* seems to be a messmate of the bees." *Laidlow* (15, vii., 1911) remarks that *Nosema* "does not appear to be the cause of much, if any, harm," and *Beuhne* (15, viii., 1911) concludes with the following summary: "Now, as *Nosema apis* has been proved all over Victoria, and there are many places in which D.T. (disappearing trouble) never occurs, we cannot but come to the conclusion, if the *Nosema* parasite is a factor in D.T. at all, it is only a secondary one, and the main cause will perhaps eventually be found in a combination of adverse circumstances."

No mention is made by any of these observers of the young stages, which according to our observations appear to be very harmful, and they seem to have relied for diagnosis on the presence of spores. Beuhne's statement that "many specimens of paralysis of the most pronounced type were entirely free from *Nosema apis*," presumably only means that spores were not found. The fact that spores were found in many of the bees examined shows that the insects were to some extent immune, or the parasite would not so frequently have reached this stage. In certain forms of *coccidiosis* it has been demonstrated that the parasites seldom reach their full development, as the host dies owing to the effects produced by the young multiplicative stages (*Fantham*, 1911). Neither "parasite carriers," so common in many diseases, nor the interesting observations on the allied disease, *pébrine*, by Bolle in Japan, are taken into consideration. The influence of the initial dose, the varying degrees of virulence of different strains of *Nosema*, the various susceptibilities of different stocks of bees, and other important factors in disease production are all neglected. By neglecting these factors one might with equal force argue that the malaria parasite is a "messmate" of man, since it is of frequent occurrence in children in certain localities, or that the *pneumococcus* is harmless, since it is often found in the mouths of healthy persons.

The observations of these authors clearly show that carriers of *Nosema apis* are very widely distributed in the districts in which their investigations were carried on, and that a large percentage of the stocks had acquired a partial immunity to the parasite. In this country "parasite carriers" seem to be less common, and the stocks less immune to the attacks of *Nosema apis*, which is undoubtedly capable of producing a fatal disease. In severely affected bees the gut epithelium may be almost completely destroyed and the desquamated cells filled with spores. When the young stages only are present the anatomical evidence of the disease is not so well marked, but judging from other similar diseases, we think there can be little doubt that the infection of a large proportion of the epithelial cells with the intracellular young stages interferes with nutrition and gives rise to constitutional symptoms often culminating in death.

The period at which the death of the bee occurs is probably greatly influenced by the weather and by other factors (pp. 35, 116). When the weather is cold and wet and the bee inactive, the parasite appears to be able to develop further and reach the spore stage, but when the weather is warm and the bee is active, the rapid multiplication of the parasite leads to the death of the bee before the spore stage is reached.

The observations hitherto described relate to the infection of the intestinal tract in worker-bees. Numerous observations, however, were made on drones, queens, excrement, combs, and honey, and the coelomic fluid and salivary glands of worker-bees, and these will now be mentioned.

Salivary Glands and Coelomic Fluid of Worker-bees.—Up to the present no bodies which we can regard as stages in the life-history of *Nosema apis* have been found in the salivary glands of diseased or normal worker bees. In the coelomic fluid certain very minute rounded bodies have occasionally been seen, as well as young stages of the parasite (F. and P.), but without further research we are unable definitely to state to what extent infection of the coelomic fluid occurs.

Queens.—It is a matter of great importance to decide whether the queen is an important agent in spreading the infection within the hive or not. Bee-keepers who have experience of this disease assert that when a stock dies out, the queen usually remains to the last, and very generally is found alive and apparently healthy with a small number of bees around her. It has been argued from this that the queen does not become infected, either because she is naturally immune to the disease, or because infection is not conveyed to her. Unfortunately, we have had no opportunities of examining queens from recently infected stocks, and have only been able to examine twelve dead and four living queens from stocks which had either died out or had almost died out. Out of twelve dead queens from infected stocks, spores were found in four, but not in the others. Four living queens from infected stocks were received; three showed young stages in the epithelium of the chyle-stomach, but no spores. *Nosema* was not found in the fourth. These examinations show that infection of the intestinal tract at least may occur in the queen. Infection of the ovaries and genital tract has not been noticed up to the present.

Since the queen does not leave the hive, except during the mating flight and when she issues with a swarm, infection must usually be conveyed to her by other bees, and there is no evidence to show that she may not become infected at an early stage. She appears, however, to be able to offer a greater resistance to the attack than do the worker-bees, since she seldom exhibits the symptoms of the disease. That this should be so is scarcely surprising, as under natural conditions the queen outlives many generations of workers. Assuming that intestinal infection occurs not infrequently in the queen, shortly after the stock becomes infected, it is of importance to consider in what ways she may be instrumental in spreading the disease. When spores are developed within the intestinal cells they pass into the lumen of the gut and are voided with the excrement. The queen deposits fæcal matter within the hive, and this is removed by the workers. Consequently, even in the absence of dysenteric symptoms, the queen, after she has become infected, may be an important factor in spreading the disease in this way. Further, the eggs may become soiled and infected as they are being laid. Infection of the larvæ may thus occur. Moreover, it is possible that the parasites may sometimes develop in the ovaries or cells lining the genital tract, and thus produce hereditary infection, though up to the present we have no evidence in support of this view.

A few experiments with queens were carried out, but yielded negative or inconclusive results, and consequently we have decided not to record them. Zander has only twice found pronounced infection of the chyle-stomach in queens. From this statement we may perhaps infer that he has not infrequently seen mild infection. Maassen, on the other hand, states that the disease has been repeatedly demonstrated in queens, but the parasite was invariably found only in the intestine and not in the genital apparatus. More frequently he found healthy queens in badly infected stocks. *Nussbaumer* (1912) says he has seen the intestine of the queen white with spores.

Drones.—On some occasions both spores and young stages of *Nosema apis* have been observed in the cells lining the alimentary canal of drones from naturally infected stocks. In a few instances the drones were the only members of the stock in which the spore stage was encountered. Experimentally also infection of the alimentary canal has been produced by feeding. The parasite has not been observed, however, in the genital organs. While Zander says that he has never found infected drones, Maassen states that drones catch the disease as easily as do worker-bees.

Larvæ and Pupæ.—*Fantham* and *Porter*, in their earlier observations already published (1911, p. 625), found larvæ infected with intracellular young stages and spores. Observations made on larvæ and pupæ from infected stocks kept in confinement have yielded negative results (G.-S.). At present, owing to the small number of observations which have been made, it is impossible to make any definite statement as to the frequency of infection of the larvæ or as to whether infected larvæ give rise to diseased bees. All that can be definitely stated is that spores have been found in healthy-looking larvæ from infected hives.

Combs.—In connection with the experiments just described, a number of observations were made on combs from normal and from both naturally and experimentally infected hives.

In the case of old combs the material was obtained from the cells, emulsified in water, and examined microscopically for the presence of spores. Larger pieces of the combs were also pounded up in water, the floating fragments removed, and the sediment pressed through fine butter muslin in order to get rid of the larger particles. Specimens from the sediment were then examined microscopically. In the case of fresh combs preparations were made from any masses of excrement which could be seen adhering to the combs, from the cell contents, and also from the larvæ and pupæ.

The normal combs were obtained from stocks which showed no signs of disease of any kind, and which were situated in districts apparently free from the Isle of Wight disease. Spores were never found in such combs.

In the preparations made from naturally and artificially infected combs, spores were occasionally found, usually in small numbers. In some specimens, however, spores were present in very large numbers, especially in the masses of excrement found adhering to the combs. Spores have also been found in honey bought in the market.

Unfortunately very few specimens were obtained from stocks infected with young forms alone. All gave negative results.

It is therefore evident that combs may carry infection so long as the spores remain alive and virulent.

Excrement.—Many samples of excrement from various sources have been examined at different times of the year. These samples were obtained from the droppings on the alighting boards and stones, &c., outside hives, from soiled combs, and from the masses actually deposited by bees under observation, as well as from the contents of the colons of bees which had died at various times previous to examination. Spores have not been found in samples obtained from normal stocks or from stocks infected with young forms only. Samples from stocks suffering from the spore stage of the disease frequently contain spores, though even in such cases a varying proportion only of the samples examined show spores. If a number of samples from such a stock are examined, some will be found crowded with spores (Plate I, Fig. 2), others only contain a few spores, while in some no spores can be found.

Experimentally it has been shown that the spores found in masses of excrement are virulent and capable of producing the disease in healthy bees when mixed with their food (p. 83). It seems probable that in nature the spores which have been voided are important factors in the spread of the disease (p. 97). In the course of our observations on infected stocks we have frequently met with apparently healthy bees capable of flying strongly, in spite of the fact that infection had occurred and some of the parasites had reached the spore stage. The excrement of such bees contains spores.

In this connection an observation of some interest was made by one of us (P.). A bee from an infected stock was seen to deposit a large amount of excrement. On examination, large numbers of spores were found in it. The bee itself was killed and examined shortly afterwards, but very few spores were found in its chyle-stomach. Possibly this bee was recovering from the disease, and if it had been allowed to live it might have voided all the spores and perhaps completely recovered.

SECTION V.

THE LIFE-HISTORY OF *NOSEMA APIS*, AND THE SIGNIFICANCE OF THE VARIOUS STAGES OF THE PARASITE IN THE DISEASE.

By H. B. FANTHAM, D.Sc., B.A., F.Z.S., and
ANNIE PORTER, D.Sc., F.L.S.

PLATES II, III, IV.

I.—*Introduction.*

The subject of this Section is the small, one-celled, parasitic organism known as *Nosema apis*. The parasite was first found by us in 1906 in diseased bees from the Isle of Wight, where an epizoötic was raging among apiaries, and from then onwards, as opportunity afforded, we have made a study of the parasite. The investigation has been one of much difficulty, since the young forms of the parasite are frail, and decompose rapidly.

Nosema apis is a minute organism belonging to the Protozoa. One stage of the parasite takes the form of very resistant, tough, oval bodies termed spores, which serve to infect new hosts. On this account the *Nosema* is placed in that section of the Protozoa known as the Sporozoa. The spores are very small, and have a somewhat complicated structure, a feature which places the parasite in the group known as the *Microsporidia*.

Among the *Microsporidia* are several organisms which are fatal to fishes, while others attack insects. One of the best known of the *Microsporidia* is a very near ally of *Nosema apis*, called *Nosema bombycis*, the organism which caused great mortality among the silkworms and enormous damage to the silk industry of France in the middle of last century. The genus *Nosema*, then, is associated with two fatal insect maladies, as *Nosema bombycis* causes pébrine of silkworms, while *Nosema apis* is a destructive agent among bees.

In this Section care has been taken to explain all technical terms, and sometimes the explanation has been repeated. We trust that this procedure will be no offence to the scientific worker, and that it will be of service to those who take a keen interest in bees without having any special scientific leanings.

II.—*Material and Methods.*

During the early part of our research we were much hampered by the paucity of material. As we could get very few infected bees—owing to the fear of bee-keepers that removal of bees would mean spread of disease—we used much of our first material for cross-infection experiments to decide whether or no *Nosema apis* really was pathogenic (see Section VI, p. 79). The life-history of the parasite was worked out to a large extent, which subsequent work has fully confirmed. It should be remarked that while an abundance of dead bees was sometimes available, these were of use only for gross diagnosis, and that living bees were absolutely essential for obtaining a knowledge of the finer details and of the young (but deadly) stages in the life history.

Much time was spent in the examination of fresh material. Bees were chloroformed rapidly, and then dissected. Smears of the gut walls were made and examined fresh. Serial teased portions of the gut were made into hanging drops on slides, or kept in small, paraffin-edged cells, sealed under a cover-glass. *Intra vitam* staining with methylene-blue was sometimes of service. Detailed examination of teased or sectioned organs other than those of the alimentary tract was also made. Eggs, larvæ, sealed and unsealed, adult workers, drones, and a few queens have all been examined in detail.

Stained preparations also were made, and the digestive tracts of some bees, both normal and infected, sectioned serially.

One important point was that detailed examinations of normal bees were made, so that errors of interpretation of various structures have been excluded as far as possible.

For fixatives, osmic acid vapour followed by absolute alcohol, corrosive-acetic-alcohol, and Bouin's picro-formol-acetic fluid were employed.

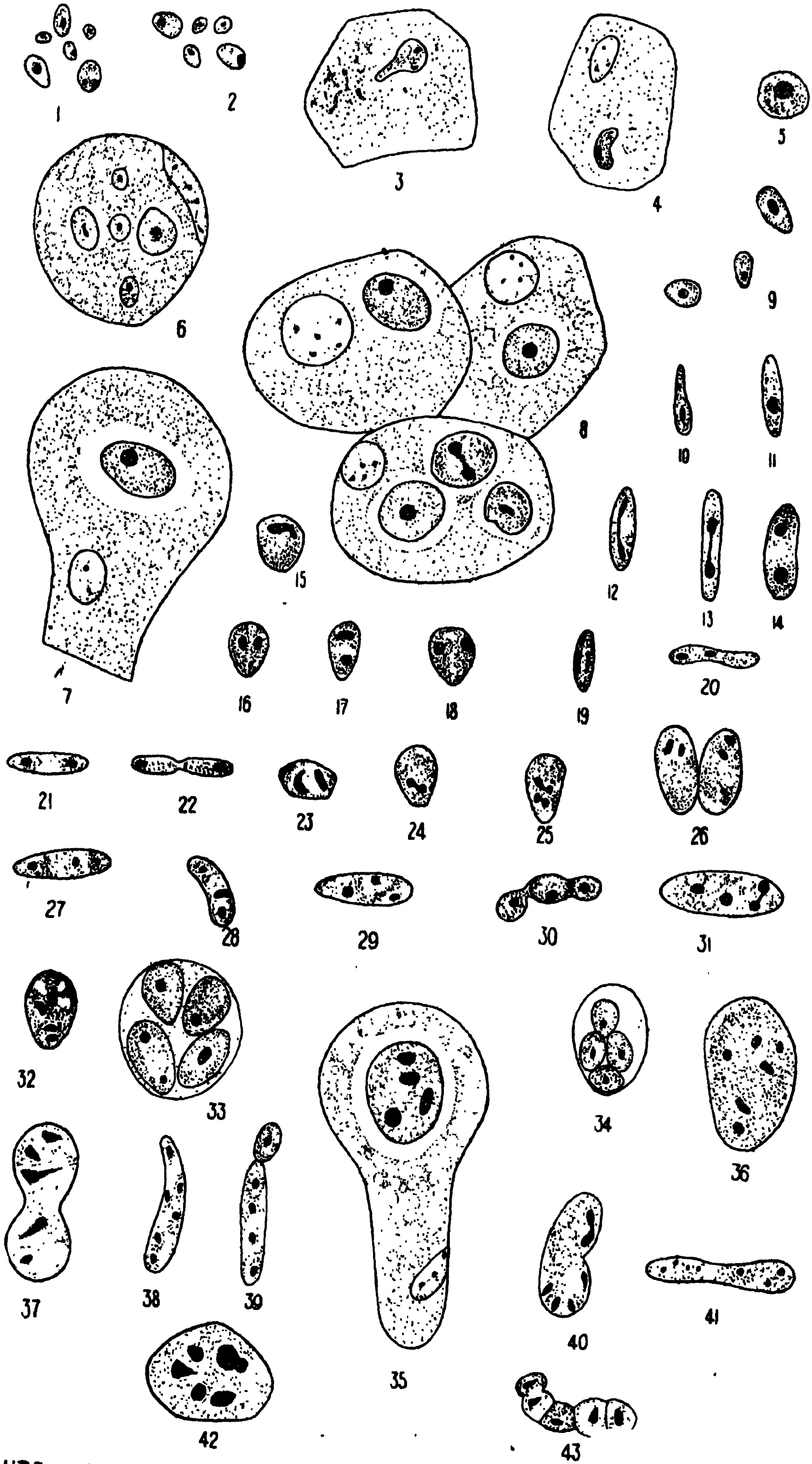
The stains that gave the best results were Giemsa, hæmatoxylin, modified Romanowsky, and glycerin-hæmatin.

Sections were usually very disappointing, because the infected epithelial cells were often shed into the lumen of the gut, and there was some difficulty in differentiating young amœboid forms from the tissues they had recently invaded.

For the elucidation of certain features, such as a thread-like coiled structure in the spore known as a polar filament, special methods were used, and are briefly indicated in the part dealing with these structures (p. 65).

III.—*Morphology and Life-history of Nosema apis.*

Several stages can be recognised in the life-history of *Nosema apis*. The first stage is that of the tiny, amœboid germ that issues



H.B.F. & A.P. del.

NOSEMA APIS

PLATE II.

from the resistant spore. This amœbula gives rise to uninucleate, daughter forms known as planonts because of their migrating or wandering habit. Planonts can increase in numbers by division, and correspond roughly to the young, feeding and growing, or early trophozoite phases of other Sporozoa.

(*a*) *The Planonts.*

Each amœbula as it issues from the spore shows two nuclei as refractile spots (Pl. II, Fig. 3). It moves by pseudopodia, one pseudopodium only being formed at a time, as a rule (Fig. 3), and this generally at one part only of the organism. The small, amœboid body may behave in one of two ways:—

(1) The two nuclei may fuse together, a process known as autogamy, after which the parasite creeps slowly between the cells of the bee's gut, and ultimately penetrates them. Division of the amœbula into two or more daughter forms may occur while the parasite is free in the lumen of the gut of the host.

(2) Protoplasm may collect around each of the nuclei of the amœbula, and then division occurs so that two daughter forms are produced. Each of these daughter forms may divide by binary or multiple fission, the latter giving rise to a colony of young planonts (Fig. 1), each of which moves about over the epithelial surface of the gut, and finally penetrates between the cells, or directly enters them (Fig. 4) and becomes intracellular. Some of the planonts can also pass between the cells of the gut and reach the body cavity or hæmocoel (Pl. II, Fig. 2).

The small planonts withdraw their pseudopodia (Fig. 4), and ultimately become round or oval (Figs. 5, 6), and are about 0·75 μ—2·5 μ in diameter. When active, their movements are slow, and the pseudopodia—probably on account of the smallness of the organism—show little differentiation into ectoplasm and endoplasm as a rule, though ectoplasm may be quite well seen occasionally in the pseudopodia. Small vacuoles are sometimes present. They are not contractile so far as could be observed. The nucleus is small, and consists of a chromatin mass or karyosome suspended in a less dense substance, the nucleoplasm (Figs. 1—6). Free planonts, on the surface of the gut epithelium or detached and smeared with the rest of the gut contents, stain fairly well with Romanowsky stains. When they become intracellular, they stain only moderately, and can be distinguished from the cell contents usually only with some trouble. The method of penetration of a cell by a planont is most difficult of observation, though it has been seen in life on a few occasions.

A point of considerable importance is that more than one young planont can enter a single cell. In certain cases (Fig. 6) a number of young parasites which are the original planonts, and which have not been produced by the division of any older, growing form, may be seen inside cells. Multiple penetration by planonts has been observed in life. Since each original individual, after a period of rest and growth, is capable of rapid division, which is repeated again by the daughter forms produced, the ultimate result of the multiple infection by the planonts on the cells invaded is to produce crowded masses of spores (Pl. III, Figs. 53–56; Pl. IV, Figs. 57, 69). These break up the intestinal lining into shred-like masses or a spongy pulp. Rapid increase in the numbers of the parasite within the same host is ensured by colonies of planonts invading individual cells of the gut, as well as by the multiplication of the parasites later.

It should be mentioned that great precautions have been taken to avoid confusion of these small planonts with other tiny organisms such as yeasts. The planonts can be distinguished from yeasts by their amœboid movements, by the definite staining of the planont nucleus, and finally by chemical tests, of which the test for fungus cellulose is the chief. Planonts have no fungus cellulose.

(*b*) *The Meronts.*

When the planonts have penetrated between the epithelial cells, one of two courses may be adopted by them :—

(i) They may reach the hæmocoel or body cavity of the bee, and remain there in a resting condition for some time. They lose their motility temporarily, become round or oval, and lie quiescent. After an interval their activity returns, and from the hæmocoel they retreat between the cells to the epithelium of the gut, which they gradually penetrate.

(ii) Other planonts are capable of penetrating the gut direct from the lumen or from between the epithelial cells. In either case the active, motile planont becomes passive, loses its pseudopodia, and enters upon the growing stage (Fig. 5), which is followed by multiplication after a short time. The intracellular parasite is now called the meront or dividing form (Figs. 7, 8).

A meront at first is uninucleate, and in this condition resembles the planont (Figs. 7–9). The structure of the meront at first only appears to differ from the planont in that the nucleus gradually becomes more chromatic and compact in nature. The organism which has now entered upon the feeding or trophic phase, rapidly increases in size, and three main forms of multiplication begin to occur among the meronts, giving rise to daughter meronts.

I. The simplest form of production of daughter meronts is by *binary fission,* but even here there is considerable variation in the forms produced, thus:—

A rounded meront usually has a round, chromatic nucleus (Figs. 7, 8). This nucleus becomes bowed, and from an approximately central position becomes nearer the periphery. The chromatin concentrates into both ends of the bow, which thus is dumb-bell shaped (Fig. 8). An indentation appears opposite the thin strand that connects the two heads of the dumb-bell, the constriction deepens, the chromatin masses separate completely, the invading ectoplasmic areas meet, and two daughter meronts are thus produced (Figs. 15–18).

These rapidly become either rounded or oval, like their parent. The nucleus of such meronts may become rounded, or it may form an elongate rod of rather more scattered chromatin granules.

A second common variation is seen when a somewhat elongate meront (Figs. 10, 11) divides (Figs. 12–14, 19, 20). The process is essentially the same as that previously described, but two meronts which are elongate are produced. The ectoplasm keeps the two in connection often for a considerable time (Figs. 21, 22), but ultimately separation is effected. Very rarely a meront is encountered in which cleavage of protoplasm has commenced before nuclear fission.

II. *Multiple binary fission* producing chains of meronts occurs. While this method of multiplication is common in *Nosema bombycis* of the silkworm, it has been our experience to find it relatively uncommon in the *Nosema* of the bees which we have examined, but we may not have examined many bees at this particular stage of infection. The chain originates by binary fission, as previously described, but without separation of the units. The nuclear fission then is repeated, giving four or more parasites. Chains of three (Fig. 30), five (Fig. 43), and other odd numbers of meronts arise by irregularity in the sequence of division of individual daughter meronts (Figs. 26–29, 37, 43). Sometimes two oval or rounded meronts still slightly connected together are encountered, and in each meront nuclear division is either proceeding so that dumb-bell shaped masses of chromatin are present, or has been completed (Fig. 26), giving two nuclei which may be round or oval. Protoplasmic cleavage is often delayed in these and similar cases (Fig. 25).

Again, it has been our experience to find a chain of several meronts in a fresh preparation, and to see it separate into its constituent individuals in the course of a few minutes. Rapid separation of daughter meronts seems characteristic of *N apis* as we have encountered it.

Pseudo-chains are sometimes produced by the rolling together and adhesion of originally distinct individuals. Great diversity of form in the nuclei enables one to distinguish pseudo-chains in stained preparations.

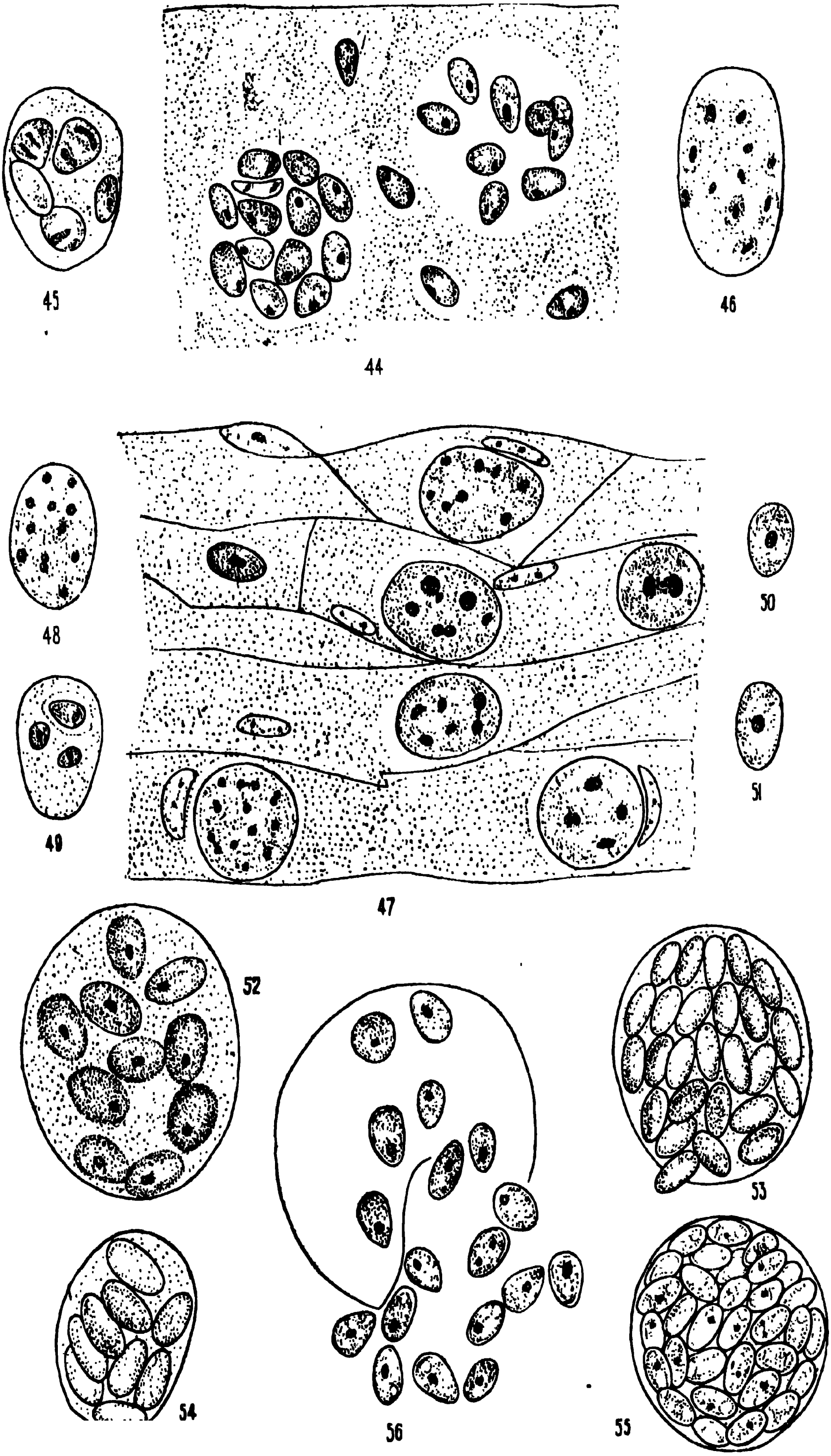
III. Sometimes a meront grows relatively large before nuclear division occurs. Two courses are then open to it. In the first case, the large meronts show some tendency to be elongate (Figs. 37–41), but on the other hand ovoid forms are encountered (Figs. 33–36, 42). A special form of large, ovoid meront is that shown in Figs. 33–35. Here a large meront produces four nuclei (Figs. 32, 35), marked cleavage of part of the protoplasm occurs, and a large amount of it concentrates around the four nuclei, giving thus four daughter meronts (Figs. 33, 34), which lie within the remains of their parent form. Similar bodies are far more common in *N. bombycis*, as described by Stempell, than we have encountered so far in *N. apis*.

Occasionally a multinucleate meront (Fig. 38) appears to bud. There is then one daughter meront given off at a time terminally (Fig. 39), instead of all the daughter forms being produced almost simultaneously (Figs. 46, 48, 52).

In the second case other meronts show great delay in the separation of the protoplasm, accompanied by rapid nuclear multiplication (Figs. 46–48). The result is that a large body suggestive of the multinucleate schizont of a Schizogregarine or Coccidium is produced. In *N. apis* we have found these large multinucleate bodies fairly often, but they do not occur in all infected bees, and when present, they usually co-exist with ordinary meronts. Around each of the nuclei of the meront in *N. apis* a spore is ultimately formed. These large meronts may be either intercellular or, as we have found more commonly, within the cells of the epithelium (Pl. II, Fig. 35; Pl. III, Fig. 47). As the epithelial cells are shed naturally into the gut, the large meronts can be found free in the lumen of the gut.

When the spores are formed, they lie within the cavity occupied by the original meronts, and the whole structure finally forms a large, often circular aggregation of spores (Pl. III, Figs. 52–55). Stempell has described similar multinucleate bodies in *Nosema bombycis*, but is inclined to regard them as abnormal forms. At present we consider the large structures of *N. apis* as merely variants of the method of growth and division preceding spore formation, which variation seems to us to depend very largely on the factors of the space and nourishment available for the parasite.

In some cases a single cell may become parasitised by several planonts in succession, with the result that recently entered planonts, meronts of all ages, and even mature spores, may be co-existing within the same cell (Pl. III, Figs. 45, 49).



H.B.F. & A.P. del.

NOSEMA APIS.

PLATE III.

We have found that some of the largest uninucleate meronts (Figs. 50, 51) about to become spores may attain a length of 7·5 μ, but there is much variation in their size.

It is of interest and of practical importance to note that many bees contain only the meront forms of *N. apis* at the time of their deaths. The tissue destruction due to these young forms of *N. apis* is very extensive, and produces weakness and exhaustion. In this respect the action of the meronts of *N. apis* may be well compared with those of the merozoites of *Eimeria avium,* which are responsible for the death of young grouse, fowls, pheasants, and pigeons.

(*c*) *Spore Formation.*

Two variations in the method of spore formation are found in *Nosema apis*, corresponding in the main to two of the different forms of merogony.

In the first case a single oval or rounded uninucleate meront (Figs. 50, 51) prepares to form a single spore. At this stage it represents the pansporoblast, or sporont of the *Myxosporidia* and *Microsporidia.* The protoplasm is finely granular, and the nucleus is distinct and at first single, though ultimately five nuclei are produced. The meront then becomes a sporoblast, and the cytoplasm contracts to a slight extent. A thin spore wall or sporocyst is then secreted externally to the cytoplasm, and thus from each uninucleate meront a single spore is produced. Figs. 53–56 represent groups of such spores. Great internal nuclear changes occur during the secretion of the sporocyst, and these are gradually obscured by the increasing opacity of the spore.

A second variation has been mentioned in that type of merogony wherein the original meront increases in size and undergoes repeated nuclear division (Fig. 48), but the separation of the nuclei and protoplasm into daughter meronts is either prevented or delayed. Ultimately around each nucleus with its protoplasm areas of delimitation are produced (Figs. 46, 52) by the gradual concentration of the protoplasm and the secretion by it of spore walls or sporocysts. Such uninucleate masses, before the secretion of the sporocyst, are called sporoblasts. Nuclear changes are obscured in the living organism to a large extent as in the previous case, but are of the same type, and will be described in some detail later. When the sporocyst is fully formed, the sporoblast becomes the spore.

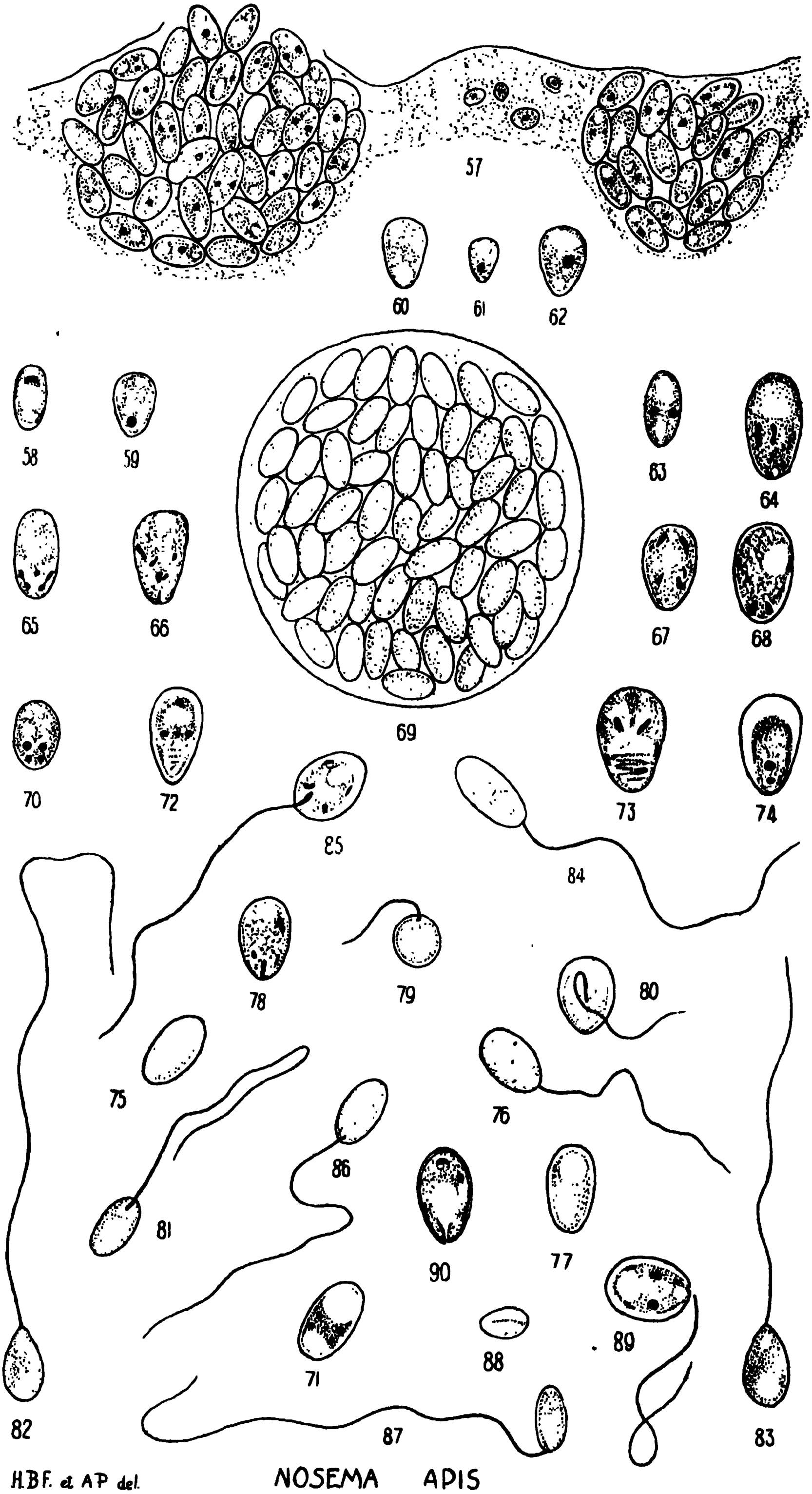
The internal structure of a mature spore is practically invisible in life, and the general impression conveyed by microscopical examination of fresh preparations is that of a mass of spores somewhat irregularly disposed lying within the remains of the host cell that was originally invaded by the single meront (Pl. III, Figs. 52–54; Pl. IV, Figs. 57, 69). When a large, multinucleate meront mass has been developed within a cavity between cells, the appearance is that of a mass of spores with a slight haze or halo around them produced by the dead remains of the parent meront.

As before mentioned, multiple infection of single host-cells by several planonts giving rise to meronts has been found (Pl. II, Figs. 45, 49). In these cases of multiple infection the meronts when dividing may interfere mutually with the separation of daughter meronts, causing temporary fusion of the various individuals. The result is that a fusion mass or plasmodium is produced. Each of the nuclei in such a plasmodium ultimately induces a concentration of protoplasm around itself, becomes a sporoblast, and finally a spore as in the previous cases.

It is thus seen that the meront becomes successively the pansporoblast, the sporoblast, and the single spore, which places *Nosema apis* in that group of the *Microsporidia* known as the *Monosporogenea* (Perez, 1906). The great power of merogony possessed by *N. apis* balances the production of only one spore from each pansporoblast.

(*d*) *Spore Structure.*

The young spore is a somewhat elongate, usually oval body (Pl. III, Figs. 53–55; Pl. IV, Figs. 57, 69), sometimes more pointed at one end than at the other (Pl. III, Fig. 56; Pl. IV, Figs. 60, 62, 66), varying in size from 4μ to 6μ long by 2μ to 4μ broad. Very occasionally a spore may reach 7μ in length. When young the contents of the spore are finely granular, and a single nucleus can be seen within them in life (Pl. IV, Fig. 61) and easily after staining. The granular cytoplasm of the spore gradually concentrates towards one end which we may term anterior. This anterior end may be somewhat pointed (Pl. III, Figs. 61, 62). The other end then becomes filled with liquid and forms a large posterior vacuole (Fig. 61), which is refractile in life. Soon tiny vacuoles form in the concentrated mass of protoplasm, and these gradually fuse together and produce a second but smaller vacuole anteriorally (Figs. 57, 58, 62, 63), which is the polar capsule. This is much more difficult to detect fresh than is the posterior vacuole. The cytoplasm then appears as a ring-shaped or girdle-like mass (Figs. 63, 71, 72) with a vacuole at either end. At about this stage nuclear multiplication commences and concomitantly the chitinoid sporocyst is secreted far more rapidly than hitherto. The nucleus first begins to elongate and becomes bowed. Gradually the ends become dumb-



H.B.F. et A.P. del.

NOSEMA APIS

PLATE IV.

bell-like, and ultimately they separate. This division then produces a binucleate spore (Figs. 63, 64). From one of the two nuclei a small bud next arises. This separates from the parent nucleus and passes towards the smaller or anterior vacuole. The nucleus, thus budded off, is the polar capsule nucleus. The second nucleus from the original division divides into two small nuclei (Figs. 65–68), which at first are rounded and are embedded in the cytoplasm, or as it is better called, the sporoplasm. These small nuclei gradually pass to the periphery, elongating and becoming thread-like as they do so (Figs. 67, 68, 73). As they control the subsequent growth of the sporocyst, they may be termed the sporocyst nuclei, and are apparently comparable to the capsulogenous cell nuclei of the Myxosporidia.

The remaining nucleus of the sporoplasm also divides into two, so that the sporoplasm is binucleate and the full-grown spore contains five nuclei (Pl. IV, Figs. 66, 67). These nuclei, as will be gathered, are not quite all the same shape and size, and do not all persist for the same length of time, so that five nuclei are not always seen in the spore together. Some apparently mature spores show only four nuclei (Figs. 71, 73, 74, 78, 85). The polar capsule nucleus (Fig. 89) and the sporocyst nuclei, after fulfilling their function, gradually degenerate.

By the time that the division of the nuclei is complete, the sporocyst has thickened enormously, and the sporoplasm which secretes the wall tends to shrink farther away from the wall in some cases (Figs. 72, 74, 85). The increasing density of the wall renders the details of the nuclear structures within very difficult of observation, and prolonged staining or staining with or without a preliminary treatment with potash or creosote, is necessary. The fully formed fresh spore is highly refractile, and a number of them seen with the microscope resemble a collection of polished grains of rice.

The Polar Filament and Polar Capsule.—Proceeding from the sporoplasm is an elongate thread, which is spirally coiled and lies usually in the vacuole at the posterior end of the spore. Unfortunately, in life it is usually invisible within the spore, and even in stained preparations can only be seen with very great difficulty. On this account Gurley called the *Microsporidia* the *Cryptocystes.* The polar filament can be induced to extrude artificially by the aid of reagents, of which we have found iodine water and dilute acetic acid the most useful. The polar filament extends from the extreme anterior end of the spore towards the posterior end. From the anterior edge of the sporocyst it passes as a straight rod (Fig. 73) backwards through the polar capsule, and after reaching beyond the greater mass of the sporoplasm, it becomes spirally coiled on itself in the vacuole (Figs. 72, 73). It measured about 60µ in some of those that we have examined. The polar filament is very difficult of observation under any circumstances. Figs. 75, 76 represent the same spore before and after treatment with iodine water.

While the spore is at rest, the polar filament remains quiescent. Occasionally, as at times of rapid induced currents in the gut of the bee, the spores thrust out their polar filaments (Figs. 79–87), which hook into the cement between the epithelial cells and temporarily anchor the parasite. The gradual protrusion of the polar filaments (Figs. 78–80) can be seen at times in fresh preparations, and is more easily observed after the addition of iodine water or weak acetic acid (Figs. 75, 76).

Again, the polar filament is extruded when the amœbula is about to leave the spore. After being vigorously flung out, the attached end of the polar filament either snaps off or is forced out of the spore by the movements of the sporoplasm within, and thus a spore is seen with a separated polar filament in its vicinity (Pl. IV, Fig. 89). A spore whose polar filament has escaped (Fig. 90) may show a very small pore marking the point of exit. The amœbula leaves the spore after the filament has been extruded and moves actively in amœboid manner away from the spore. Spores devoid of amœbulæ can be found, and then the sporocysts, sometimes with two sporocyst nuclei, are recognised as empty by their decreased refractivity and the pores whence the polar filaments have escaped.

(*e*) *Variations in the Appearance of Spores.*

While a very large proportion of spores show the features as detailed previously, yet there are certain well-marked differences in the form of young spores more particularly, which are the results partly of the conditions of nutriment under which the parasites develop, and of the space available for their development.

(1) Young spores often are not perfectly oval, but are more pointed at one end (Fig. 72). Others, on the contrary, become much more rounded (Fig. 79). While the egg-shaped condition is fairly common, the rounded form is rarer.

(2) Young spores may not show the vacuole and smaller polar capsule at once, but protoplasmic strands may cross either cavity, and so the appearance of several vacuoles is produced (Fig. 70). Ultimately these vacuoles fuse, and the final result is the production of a single large posterior vacuole and a polar capsule.

(3) While a small, but not very obvious, thickening (Figs. 79–81) is present at the attached end of every polar filament,

in a very few cases this thickening appears much enlarged (Fig. 85). It is, however, a more common condition to find the thickening very slight. Occasionally, in fact, it appears to be absent altogether.

(4) Variations in the position of the sporoplasm are not very great as a rule. Some cases have been observed in which the sporoplasm receded far into the spore, the polar capsule being greatly enlarged. A small posterior vacuole is sometimes present (Figs. 59–63, 65), and the vacuole may be somewhat lateral (Fig. 68). Spores in which the polar capsule was very slight (Figs. 58, 64) have also been found.

(5) There is much variation in the position of the nuclei contained in the spore. The most typical case of the quintinucleate spore is where the sporocyst nuclei are laterally placed, the polar capsule nucleus is near the polar capsule, and the sporoplasmic nuclei more or less central (Figs. 66, 67, 89). The polar capsule nucleus, however, not infrequently lies in the sporoplasm, and is only differentiated from the sporoplasmic nuclei by its somewhat smaller size. Similarly, the sporocyst nuclei may be rounded (Fig. 70) instead of elongate, and they may lie in almost any position in the spore, instead of being lateral (Figs. 70, 72, 78, 90).

(6) Young spores may show transverse wrinkles in their outer surface in stained preparations. In fresh preparations, such wrinkles are not visible, and they are to be regarded as artifacts due to the action of fixatives.

IV. *The Homology of the Microsporidian Spore and its Contents.*

The multinucleate condition of the sporont and spore of the *Microsporidia* is, at first sight, perplexing, and though many explanations seem to have been attempted, yet few are satisfactory, and they fail to reveal the undoubted affinity which exists between the *Microsporidia* and the *Myxosporidia.* The *Microsporidia,* e.g., *Nosema,* on account of their marked parasitism, have developed great reproductive power. In the case of *N. apis,* this is seen in the great and varied power of merogony in the host, which compensates for the relatively limited capacity for sporogony, as seen in the production of only one spore (monosporogony) from a sporont or pansporoblast.

Many of the spores of the *Myxosporidia* contain two polar capsules, and two spores are usually formed in each pansporoblast. About ten nuclei are commonly found in such a pansporoblast. We could attempt directly the homology of the four or five nuclei of the Microsporidian pansporoblast with those of the Myxosporidian pansporoblast, but the comparison is, in our opinion, far more certain and convincing if we consider the annectant form, *Coccomyxa,* whose sporogony has been described by *Léger* and *Hesse* (1907).

Coccomyxa morovi, a parasite of the Sardine, is a monosporous Myxosporidian showing many points of resemblance with the *Microsporidia.* The single bivalve spore of *Coccomyxa,* produced by each pansporoblast, contains a clearly visible, single polar capsule. Within the young spore there is a binucleate sporoplasm, two nucleated capsulogenous or valvular cells, and one nucleated polar capsule cell. Thus we see that within a developing pansporoblast of *Coccomyxa* there are found five nuclei. This fact is one of the utmost interest and importance, for it reveals in the clearest possible manner, and in a way which apparently has not been clearly pointed out before, the affinity with the Microsporidian spore, *e.g.,* the spore of *N. apis.* Both spores contain a binucleate sporoplasm. The single, oval sporocyst of *N. apis,* is, we believe, homologous with the bivalve "shell" or spore-coat of *Coccomyxa* and other *Myxosporidia.* In the formation of the spore of *N. apis* we clearly see two sporocyst nuclei, which arrange themselves opposite each other at the periphery of the spore. The sporocyst of *N. apis* is not bivalved, nor is there a sutural line, but it is of interest to note that long ago, before we thought of comparing the spores of *Nosema* and *Coccomyxa,* we noticed in a very few cases a more or less longitudinal "line of weakness" (Pl. III, Fig. 88), suggestive of the sutural line of the Myxosporidian spore. Lastly, there is a polar capsule in the spores of *Coccomyxa* and *Nosema,* though in the latter the polar filament is not visible in life, and so is termed cryptocystic. The polar capsule in each case arises from a potential nucleate cell. These homologies throw interesting light on the phylogeny of the *Microsporidia.*

V.—*Distribution of the Parasite in the Host.*

Nosema apis is, at the present time, a specialised parasite in that its parasitism is restricted almost entirely to the organs of the alimentary tract. Spores of *Nosema* are found occasionally in the œsophageal portions of the food canal. These have been freshly ingested. The honey stomach of the bee also rarely contains more than the freshly absorbed resistant spores, though on a few occasions we have found the small, amœboid planonts creeping over the lining of the crop and beginning to penetrate its cells. Beyond the crop is the small lock that leads into the more muscular mid-gut or chyle-stomach. The walls of this organ are more easily attacked than those of the fore-gut, and the small amœbulæ creep from the spores, which are now softened by the digestive juice of the bee, and after moving about for some time penetrate the walls, round off, and become meronts. The amœbulæ are found in all parts of the chyle-stomach, but it is not uncommon to find one portion of the organ swarming with parasites while a very short distance away the tissue is absolutely uninfected. Again, multiple infection of cells in one special area may be common, while the neighbouring portion contains very few, widely distributed parasites.

The chyle stomach narrows to form the small intestine, in which the same condition of distribution prevails. But here some of the spores which are produced from parasites in the chyle stomach come to rest. Polar filaments are ejected, and the spores anchored temporarily. The small amœboid germ emerges, and proceeds, either with or without dividing, to penetrate new cells of the intestine. This auto-infection of the bee with spores from its already contained parasites, only goes on to a limited extent, but it certainly occurs.

The hind-gut is rarely a seat of actual invasion by the *Nosema*, but its contents may be milk-white, instead of yellowish, on account of the *Nosema* spores which have been shed into it.

The chyle stomach is actively secretory in a normal bee. Recent work on the formation of the bee's digestive fluid seems to indicate that the large secretory cells form the fluid within them in small drops. The drops are not expelled as such, but the cell in which they are formed is detached, and falls into the lumen of the gut, where sooner or later its contained fluids are set free by its disintegration. These large, rounded secretory cells become invaded by *N. apis,* and consequently globular cells containing young stages of *Nosema* (Pl. I, Fig. 7), multiplicative forms of various types (Pl. I, Fig. 35), and even fully formed spores (Pl. II, Fig. 53) are found floating freely in the gut contents. It may be mentioned that the bee is constantly renewing the secretory cells, and it is possible that active shedding of infected cells may result in the removal of many parasites, and cause the bee to become healthy for a short time, and so aid in explaining apparent recoveries from attacks of *Nosema apis.* Incidentally, the young stages of the parasites are thus lost, and so are seldom seen in sections of infected gut.

The colon and rectal regions of the bee are practically unattacked by the parasite.

Detailed examination has been made of the organs other than those of the main digestive tract. The Malpighian tubules are very numerous, and as they pass off from the gut and have an excretory function, much attention was given to examining them. On one occasion only was any parasite found in the Malpighian tubules, and then meronts and a few spores were found in one tubule only of one bee.

Examination of the salivary glands and wax glands has, so far, proved negative, no form of parasite having been found therein.

The generative organs have been subjected to detailed examination whenever possible. The testes of drones, however, have so far proved negative, though the alimentary tracts of drones are frequently infected. It is, of course, of importance to decide whether hereditary infection occurs, as it does in silkworms. So far the material available for examination prevents the expression of a definite opinion; out of six queens examined by us, in one case only were there indications of *Nosema* in the ovaries, although three of them contained spores in the gut. This part of the investigation is of great interest, but much more material is needed before authoritative opinions can be given. However, it must be noted that while it is at present doubtful whether ovarian infection occurs in the queens, there is no doubt that in queens the alimentary canal can be heavily parasitised by *N. apis*, and that queens die of the disease, though they may be the last to die in the hive. Owing to the infection of the digestive tract of the queen, there is the possibility of eggs becoming soiled with *Nosema* spores when being laid.

Careful examination has been made of the hæmocœlic fluid of bees. In the first instance, much work was done on the hæmocœlic fluid of normal, healthy bees, so that the corpuscles of the fluid were well known. The fluid was obtained by snipping off legs from the bees, and taking up the drops of fluid that exuded in a fine pipette or placing them directly on to a slide. This fluid was either examined fresh or after fixing and staining. A similar procedure was adopted with bees known to be unhealthy and suspected of containing *Nosema*—a suspicion confirmed by subsequent dissection. The results of examination of fresh preparations showed that small amœboid bodies, certainly foreign to healthy bees, were present. Examination of stained preparations showed that these bodies were identical in form and structure with the wandering planonts of *Nosema apis*. In about six instances in which these small bodies were found in the hæmocœlic fluid, the chyle stomach of the bees contained a far greater number of planonts, whose movements and appearance were carefully compared with the intruders. We were forced to conclude as a result of this that the planonts could and did pass through the intestinal wall, reach the hæmocœlic fluid, and remain there. Also, we found older stages, the meronts, and in one case one or two spores were seen in the hæmocœlic fluid. We know well that such development occurs in the case of pébrine in the silkworm, and there seems little reason to suppose that *N. apis* is more limited in its possible powers of migration than *N. bombycis*.

But *N. bombycis* is much more deadly than *N. apis*, as it already possesses the power of invading every tissue of the body and of even destroying the muscles. Should the power of diffuse infiltration possessed by *N. apis* increase with time there is the possibility of the virulence of the parasite increasing enormously.

Immature bee grubs of varying ages have been examined, and found to contain *N. apis*, particularly in the meront stage, while occasionally a few spores were found in the cells of the mid-gut of the young hosts. Whether the bee grubs were infected by means of their food or hereditarily, there was not enough evidence to show. It seems, however, that the contaminative method is more probable than the hereditary one. It may be mentioned that grubs from one particular infected hive appeared somewhat smaller than normal bee grubs.

Muscular tissues of diseased bees also have been examined repeatedly. Except in a few instances where the parasites had developed near the muscles or against the sarcolemma of the muscles of the gut, the muscular system appeared free from the parasites. *N. apis* in this respect is very unlike *N. bombycis*, by whose action the muscle substance is destroyed, and ultimately the sarcolemma becomes largely filled with masses of meronts instead of muscle substance.

To sum up, the main alimentary tract of the bee, particularly the chyle stomach and intestine, are the chief parts infected. The gut diverticula appear to be free from parasites, but as the *Nosema* may be found in the hæmocœlic fluid, the parasite may occasionally invade other organs.

VI.—*Inter-relation of the Parasite and the Host.*

Action and reaction are equal and opposite according to physical laws. We may then inquire as to what relationship or interaction exists between *N. apis* and its host. In examining fresh preparations of bee-guts infected with *Nosema*, we have often found the large intestinal cells containing one meront lying free in the gut lumen. Each meront appeared to be lying in a clear space, and had the appearance of being surrounded by a halo. No space was seen around the meront which had only just become intracellular. The more mature the meront, the more marked was the space (Pl. II, Fig. 35).

The production of the space around the meront may be due to two causes:—(1) Stempell, when working on *N. bombycis*, notes a similar space, and ascribes it to the action of a ferment produced by the parasite. The same may be true in the case of *N. apis*. The said ferment decomposes the protoplasm, and the dissolved products serve as nourishment for the parasite. Support is given to this hypothesis by the gradual appearance of the space around the organism, suggesting, as it does, progressive destruction of the surrounding tissue.

(2) The clear area may be due to the removal by simple absorption from the cytoplasm of the invaded cell of various granular constituents, used by the parasite as food. The organism would then exercise a sort of selective absorptive power, which would alter considerably the concentration of the liquids external to itself.

This view is supported by the fact that when the cells containing the parasites burst, and so discharge the parasites into the lumen of the gut, part of the "halo" passes out as an investing sheath around the parasite, while a small portion remains behind. The alteration of the fluidity of the nearest cytoplasmic zone of the host-cell around the parasite would allow of this occurrence. The "halo" is not an integral part of the parasite, for it gradually disappears in water or normal salt solution, and the process can be hastened by warming. The meront is then left with a clear-cut, ectoplasmic outline, which does not alter.

It might be suggested that the clear area is an attempt on the part of the host to shut off the parasite. We do not think that such is the case, for the parasite certainly grows much more rapidly during the period when the halo is large than when it is smaller. This would hardly be the case were its nourishment being restricted in quantity or quality.

The tissues of the host undoubtedly offer some resistance to the parasite, and the result is the production of intercellular multinucleate meronts and spores as mentioned previously. But the parasite is, even in this condition, able to mature spores, and spore formation may be interpreted as due to the reaction of the host upon the parasite, causing the latter to shorten its active career in that particular host, and to assume a form suitable for conveyance to a fresh bee.

The passage of the spores outwards into the lumen of the gut causes tears and gaps to appear in the intestinal wall. The bee, however, has great powers of reforming cells, owing to the method by which its intestinal juice is produced, and consequently the number of torn cells as seen in sections is not necessarily great. Injured cells are merely voided and new ones formed to replace them. When an intense infection is present, the bee seems to lose its power of re-forming cells, and as a result the digestive processes are far more deranged, the bee weakens rapidly, and dies. The chyle stomach at the time may be full of *Nosema* spores, when its normal reddish colour disappears, and it becomes chalk-white in colour.

The presence of the parasite in the hæmocœlic fluid has an important bearing on its possible pathogenic effects. *Nosema apis* at present appears to be largely confined to the digestive tract, but as it is able to live in the hæmocœlic fluid, there are great possibilities of it becoming like *N. bombycis,* which is capable of attacking any and every tissue of the silkworm, and therefore is infinitely more deadly. The deadliness of a parasite depends in part on its power of multiplication within one host. This power is very great in the case of *N. apis,* and its multiplication is brought about in many ways. The second factor influencing the fatal or non-fatal effect of a parasite is the extent of its distribution. When the parasite can penetrate every tissue so that it is diffusely infiltrated throughout the host, the damaging capacity is enormously greater than when the parasite is localised. As *Nosema apis* varies in its power of diffuse infiltration (as shown by its presence in the hæmocœlic fluid in many cases, and on one occasion in the Malpighian tubules), its potentialities as a deadly organism may increase.

Much time and thought have been given to the consideration of the variation in virulence of *N. apis* in bees, but little definite evidence can be produced on this subject. However, it is known that in certain other protozoal diseases, such as various forms of Trypanosomiasis, that the newer the parasite is to the host, the more deadly is it found to be. Also, it has been shown that after a time the host acquires the power of tolerating the parasite to a greater or less extent. Arguing by analogy with *N. bombycis,* which is fatal to silkworms in practically all European cases, it would seem probable that *Nosema apis* has been a parasite of bees for a longer period than *N. bombycis* has of silkworms. If such be the case, there is then the possibility of an immune race of bees developing, and, indeed, certain experiments in cross-infection have shown that some bees may feed on honey containing thousands of *Nosema* spores and yet be unaffected by them. Possibly many Australian bees are immune to the effects of *N. apis.* If a weak strain of bees is infected with Nosema, the disease might run riot among them, for any pathogenic parasite can easily overcome the resistance of a weak host. Immune bees are very dangerous as they act as parasite-carriers.

Bees in the early spring are weaker after their hibernation than they are in the summer. Consequently, if they have harboured *Nosema* in their mid-guts during the winter, or acquire it very soon after their awakening, the parasite may be expected to get the upper hand of the bees, and an outbreak of disease is reported. Bad seasons have a similar effect in lowering the vitality of the bees, and so rendering them easier victims to *Microsporidiosis.*

VII.—*Summary of Life Cycle and its Significance.*

The most conspicuous form in the life-history of *Nosema apis* is the spore. This may form the starting point in the life-cycle. When the spore is taken up mixed with food, it generally passes forwards into the chyle stomach of the bee before much change occurs in it.

Within the chyle stomach the spore wall is softened by the action of the digestive juice of the bee, which penetrates to the spore-contents. Stimulated by the juice, the sporoplasm apparently presses the vacuole, with the result that the polar filament is forcibly ejected. It serves for a short time as an organ of attachment, fixing the spore to the gut wall. The sporoplasm concentrates and moves forwards, whereby the polar filament is forced still farther outwards, and becomes disconnected from the spore. The sporoplasm, retaining two of the nuclei, creeps out from the sporocyst, leaving the two sporocyst nuclei behind. The free sporoplasm becomes amœboid. The binucleate amœbula creeps about over the intestinal surface. The nuclei may fuse, or more often, the amœbula proceeds to form daughter amœbulæ. The final active amœbulæ are small, roundish organisms, each with a single nucleus containing a karyosome. Each amœbula is capable of amœboid movement. It penetrates the cells of the gut, or else between them, and finally either enters one of the cells or goes beyond and floats in the hæmocœlic fluid.

Assuming that it enters an epithelial cell of the gut, it becomes rounded and passive therein, and after a period of growth, during which time it is known as a trophozoite, commences to multiply by several methods. There results usually a collection of separate daughter individuals or meronts, or chains of meronts. The chain condition is somewhat less common than the separate forms in our experience so far. Each meront is uninucleate. Alternatively, a meront may form a large, multinucleate body, in which cleavage into daughter meronts does not occur. Such bodies may be intercellular or intracellular.

After a period of active growth and division producing uninucleate meronts, spore formation begins. The organism is now called a pansporoblast. Active amitotic nuclear division occurs, resulting in the production of five nuclei. Two vacuoles also form in the developing spore, a large one at one end, called the posterior vacuole, and a small one at the opposite end, forming the polar capsule. The living body substance or sporoplasm then forms a somewhat ring-shaped mass between the two vacuoles, and in it are lodged the five nuclei arising by division from the meront nucleus. Two migrate to the sides. These become elongated, and may be termed the sporocyst nuclei. Of the other three nuclei, one controls for a time the polar capsule, and the other two the sporoplasm. The polar capsule gradually forms the spiral polar filament, which extends down into the posterior vacuole. While these nuclear changes are taking place in the sporoblast or young spore, the latter is forming a coat around itself. This spore coat or sporocyst gradually thickens and obscures the nuclei beneath, and the final result is that from one pansporoblast a single spore, resembling a rice grain in shape, with a shining refractile sporocyst is produced. In this condition the spore passes into the lumen of the gut, is voided with the fæces, and remains a source of infection for some time.

It will thus be realised that there are two distinct phases in the life-cycle of *Nosema apis* within the bee. This feature *Nosema* holds in common with other protozoal parasites, such as the Coccidium fatal to game birds and poultry.

The first part of the life of *Nosema* is occupied in growth and active division, so that the number of parasites within the host is enormously increased. This multiplicative stage, known as merogony, is the one that is most dangerous to the host. The young stages of the parasite alone are sufficient to kill the bee in many cases, and the parasite, as a result, may never reach the final or spore stage of its development. Young grouse similarly are killed by the multiplicative stages (merozoites) of *Eimeria (Coccidium) avium.*

When the power of the parasite to multiply more in the one host is exhausted, or when the bee can no longer supply it with sufficient food, it becomes necessary for the *Nosema* to leave its host and to renew its development in a new one. Consequently, the parasite must protect itself in order to survive the period between leaving one host and entering the next. As a result of this need, the parasite forms a hard outer covering or spore coat, and becomes a spore. The spores are highly resistant to outside conditions, can live for some time without losing their infective power, and so can become new sources of infection for other bees.

In other words, merogony of *N. apis* serves for the infection of, and has fatal effects on, a single host; sporogony is a means for the spread of the disease to new hosts.

Concluding Remarks.

In conclusion, we may state that the complete life-cycle of *Nosema apis* in the adult of the hive bee, *Apis mellifica,* is here set forth for the first time, and from what we have seen, it is probable that the cycle in the larvæ follows on exactly the same lines. We keenly desire to obtain the necessary material for investigating the possibilities of the hereditary transmission of *N. apis*, a problem which not only presents many difficulties of investigation, but is also of great practical importance in the combating of disease.

Explanation of Plates II, III, IV.

All figures were outlined with the Abbé-Zeiss camera lucida; 2 mm. apochromatic and $\frac{1}{12}$ in. achromatic objectives (Zeiss) and compensating oculars 8 and 12 were used.

PLATE II.

Magnification of figures approximately 1,500, except Fig. 6, which is 2,150.

Fig. 1.—Group of planonts of *Nosema apis* from chyle stomach of *Apis mellifica*.

Fig. 2.—Group of planonts from the hæmocoel of the bee.

Fig. 3.—Binucleate amœbula, showing pseudopodium. Fresh preparation.

Fig. 4.—Amœbula becoming round in epithelial cell.

Fig. 5.—Meront with large nucleus.

Fig. 6.—Epithelial cell from chyle stomach of the bee containing planonts and meronts.

Fig. 7.—Meront lying in a space in epithelial cell.

Fig. 8.—Group of three epithelial cells containing growing meronts. One cell contains three meronts, and of these one is dividing. Nuclei of host cells are faint.

Fig. 9.—Three young, growing meronts.

Figs. 10, 11.—Narrow meronts.

Fig. 12.—Meront in early stage of division, nucleus bowed.

Fig. 13.—Further dumb-bell stage in division of nucleus of meront.

Fig. 14.—Broader meront showing complete separation of daughter nuclei.

Figs. 15-18.—Dividing ovoid meronts.

Fig. 19.—Narrow, oval meront with elongate nuclei.

Figs. 20, 21.—Narrow meronts.

Fig. 22.—Two daughter meronts still united by their ectoplasm.

Fig. 23.—Meront with large nuclei.

Fig. 24.—Meront with nucleus dividing into two.

Fig. 25.—Meront in process of multiple nuclear division.

Fig. 26.—Two meronts from one division remaining attached and dividing again.

Figs. 27–29.—Meronts with three nuclei.

Fig. 30.—Chain of three meronts.

Fig. 31.—Meront with nucleus dividing to form four daughter nuclei.

Fig. 32.—Quadrinucleate meront showing small vacuoles. This is not common.

Figs. 33, 34.—Four daughter meronts within the remains of the parent meront,

Fig. 35.—Large epithelial cell with quadrinucleate meront.
Fig. 36.—Multinucleate meront with six nuclei.
Fig. 37.—Somewhat irregular meront from between epithelial cells, destined to produce five spores.
Fig. 38.—Long meront with six nuclei.
Fig. 39.—Long meront from which a daughter meront is budding.
Figs. 40–42.—Multinucleate meronts of various forms.
Fig. 43.—A chain of five daughter meronts which have not yet separated from one another.

PLATE III.

Magnification approximately 1,500.

Fig. 44.—Piece of tissue from the midgut gut of a bee, infected with *Nosema apis*, showing two colonies of meronts lying in spaces, and four isolated meronts that have recently penetrated the tissue. Hæmatoxylin.
Fig. 45.—Single epithelial cell as shed into the lumen of the gut, containing three dividing meronts, one single meront, and a practically ripe spore.
Fig. 46.—Large meront with daughter meronts differentiating within it.
Fig. 47.—Tissue showing large, multinucleate meronts in various stages of division.
Fig. 48.—A large meront similar to those shown in Fig. 47, but set free in the gut.
Fig. 49.—Epithelial cell showing the successive penetration of three planonts producing meronts.
Figs. 50, 51.—Meronts about to become spores.
Fig. 52.—Large meront with ten daughter meronts within it.
Figs. 53–56.—Forms of cells containing spores in varying numbers.
Figs. 53, 54.—Cells filled with spores of *N. apis*, shed into the lumen of the gut. Fresh preparations.
Fig. 55.—A similar cell containing meronts and young pansporoblasts. Hæmatoxylin.
Fig. 56.—An epithelial cell bursting and liberating meronts and pansporoblasts into the gut.

PLATE IV.

Magnification approximately 1,500 *diameters, except where otherwise stated.*

Figs. 57–69.—Various stages in the development of spores.
Fig. 57.—Piece of epithelium showing two nests of sporoblasts and young spores of *N. apis*. The tissue between the colonies shows four recently entered meronts. Hæmatoxylin.
Fig. 58.—Young uninucleate sporoblast showing two vacuoles, the posterior of which has not assumed its final position.
Fig. 59.—Uninucleate pear-shaped sporoblast with small vacuole.
Fig. 60.—Young spore with large anterior polar capsule.

Figs. 61, 62.—Show formation of polar capsule and posterior vacuole.

Figs. 63, 64.—Spores showing two nuclei, those of 64 being about to divide again. Giemsa.

Figs. 65–67.—Spores showing the full number of nuclei (5). Fig. 66 shows base of polar filament. Giemsa. x 2,150.

Fig. 68.—Spore with vacuole to one side. Hæmatoxylin. x 2,150.

Fig. 69.—Host cell containing colony of mature spores.

Figs. 70–78.—Different appearances shown by spores after treatment with various reagents. x 2,150.

Fig. 71.—Spore showing four nuclei and girdle-like sporoplasm. Giemsa.

Fig. 72.—Somewhat oval spore showing three distinct nuclei, girdle-like sporoplasm, and indications of coiled polar filament. A fourth nucleus, that of the polar capsule, shows faintly. Long staining with modified Romanowsky, after treatment with creosote.

Fig. 73.—Larger spore, similar to 72, but showing the base of polar filament at the broad end. Giemsa, after creosote.

Fig. 74.—Spore showing nuclei well.

Fig. 75.—Oval spore, as seen fresh, in water.

Fig. 76.—Same spore as 75, but swollen slightly, and with polar filament extruded after treatment with iodine water.

Fig. 77.—Oval spore, showing large posterior vacuole after creosote.

Figs. 78–80.—Show gradual protrusion of polar filaments. Spores treated with dilute acetic acid.

Figs. 81–83.—Spores with polar filaments extruded. Iodine water.

Figs. 84, 86.—Fresh spores with polar filaments extruded. Free in the gut of the host. Physiological saline.

Fig. 85.—Spore showing polar filament with thickened base, binucleate sporoplasm, 2 sporocyst nuclei. Giemsa, after creosote.

Fig. 87.—Fresh spore with polar filament extruded. From bee larva.

Fig. 88.—Small spore from epithelial cell of larva of bee, showing line of weakness.

Fig. 89.—Spore with polar filament just escaped and lying near it. Binucleate sporoplasm and two sporocyst nuclei present, with remains of polar capsule nucleus. x 2,150.

Fig. 90.—Spore that has lost its polar filament, showing minute pore through which the filament escaped. x 2,150.

SECTION VI.

EXPERIMENTAL INFECTION WITH *NOSEMA APIS*.

In 1857 *Dönhoff* and *Leuckart* found small refractile oval bodies in the intestines of diseased bees, and thought that these bodies were the spores of a fungus. That they did not recognise the possibility of the animal nature of the parasite is not surprising, for at that time unicellular animals, such as these protozoa, were almost unknown. It is possible that the bodies they described were the spores of *Nosema apis*. They succeeded in communicating the disease to healthy bees by feeding them with the spores.

In 1858 *Higgins*, and in 1863 *Leydig*, also observed spores which may have been those of *Nosema apis* in bees, but apparently did not carry out any infection experiments.

Since that time little, if any, attention was paid to the parasite till it was independently found by Fantham and Porter in 1906, and Zander in 1907, and named *Nosema apis*.

Between 1906 and 1911 a number of infection experiments were carried out by Fantham and Porter, which are first described. During 1911 further infection experiments were carried out by Graham-Smith and Bullamore. These are described later.

A. EARLIER INFECTION EXPERIMENTS.

By H. B. FANTHAM, D.Sc., B.A., and ANNIE PORTER, D.Sc.

Since 1906, when we received some diseased bees from friends in the Isle of Wight in which we discovered *Nosema apis*, we have made a number of infection experiments, which may be classified in the following groups:—

I. *Feeding Experiments with honey artificially infected with the spores of Nosema apis.*—In June, 1906, twelve healthy bees, obtained from a district free from the disease, were fed on honey contaminated with the spores of *Nosema apis* taken from the gut of infected bees. After two to four days they became quiet and showed a disinclination to move, and spores (probably ingested with the food) were found in the fæces. All were dead at the end of ten days. Six controls fed on uncontaminated honey remained alive

and well. In a similar experiment carried out in June, 1907, eight bees fed on infected honey died within eleven days, while eight controls remained healthy. In June, 1910, six bees fed on infected granular honey died within seven days, while six controls remained healthy.

In each set of experiments the dead bees were dissected, and the gut epithelium was found to be heavily infected with the spores of *Nosema apis*.

II. *Feeding Experiments with honey or syrup contaminated with the fæces of bees infected with Nosema apis.*—In June, 1907, three sets of experiments were carried out by feeding bees on honey contaminated with the fæces of infected bees. Ten bees were used in each set. In these experiments all the bees died within eight, ten, and eleven days respectively. Ten controls to each set were used, and were kept alive for twenty to twenty-nine days.

In June, 1908, a similar experiment was made with six bees which were fed with syrup contaminated with excrement. All died between the eighth and tenth day. Six controls remained alive and healthy for four weeks.

III. *Bees infected with Nosema apis and in a weakened condition were introduced into cages containing healthy bees. All were fed on pure honey.*—The healthy bees endeavoured to expel the sickly ones, which thereupon defæcated freely, fouling both the cage and the food supply. Consequently the healthy bees ingested the spores present in the fæces of the diseased bees and became infected, and all died. By microscopic examination, they were shown to be severely infected with *Nosema apis*. Control bees associated with bees apparently dying of overwork remained healthy for some weeks.

In June, 1908, six diseased bees, only capable of crawling, were placed in a cage with twenty-five healthy bees. The results of this are given below:—

5 bees were found dead on the 3rd day
4 ,, ,, ,, ,, 8th ,,
6 ,, ,, ,, ,, 10th ,,
3 ,, ,, ,, ,, 11th ,,
4 ,, ,, ,, ,, 12th ,,
3 ,, ,, ,, ,, 13th ,,
2 ,, ,, ,, ,, 15th ,,

The honey used in all these experiments was first examined in order to make sure that it was not naturally infected.

IV. *Healthy bees placed in a cage in which infected stock had travelled.*—In May, 1907, eight healthy bees caught on the wing were placed in the soiled cage. All were dead at the end of nine days, and *Nosema apis* was demonstrated in the intestinal cells in all cases. Eight controls remained alive for at least a fortnight.

In June, 1908, twelve healthy bees caught on the wing in the open country were placed in an infected cage. Six were dead on the eighth day, four on the tenth day, one on the eleventh day, and one on the thirteenth day. *Nosema* infection was demonstrated microscopically. Of the twelve controls all except one, which died on the tenth day, lived a fortnight. *Nosema* was not found in the controls.

V. *Infected excrement smeared on healthy bees.*—In these experiments excrement containing spores of *Nosema apis* deposited by diseased bees was smeared in small quantities on the bodies of healthy bees. The bees immediately proceeded to clean themselves and died of *Nosema* infection. Controls smeared with the excrement of normal bees also cleaned themselves, but showed no signs of disease and did not contain the parasite. They lived from two to four weeks. Experiments of this kind were performed in May and June, 1907, 1908, 1909, and 1910.

VI. *Feeding with honey from an infected hive.*—In June, 1907, twelve healthy bees were allowed to feed on honey in the comb obtained from a hive in which all the bees had died. Ten of these died within twelve days, and the remaining two died at the end of fifteen days. Microscopically, infection with *Nosema apis* was proved.

Controls which were observed for three weeks remained alive and apparently healthy.

B. INFECTION EXPERIMENTS CARRIED OUT DURING 1911.

By G. S. GRAHAM-SMITH, M.D., and G. W. BULLAMORE.

Maassen refers to various observations on stocks in confinement, but only quotes one experiment on a healthy stock. In this case healthy bees (without the queen), covering two frames, were placed in a hive. Twelve bees were infected, marked on the back with zinc white, and placed in the hive. After eight days 40 per cent. of the bees were found to be infected, and after three weeks every bee taken from the hive contained the parasites. A control set from the same stock remained healthy.

Our own experiments were undertaken during 1911 before we had received any detailed information about the observations which have just been quoted. These experiments may be divided into two sets: (I.) those on small numbers of bees confined in bell-jars and cages, and (II.) those on whole stocks kept in confinement.

I. *Experiments on small numbers of bees kept in bell-jars and cages.*—These experiments were undertaken in order to ascertain whether bees could be infected with the spores of *Nosema apis,* either old or fresh, and if so, under what conditions. It was found that infection could be produced with a variety of *Nosema*-infected materials, but that while some experiments were highly successful, others in which the conditions were apparently identical produced negative results. The factors which influence the results have not been yet determined.

In order to illustrate the methods used and the results obtained, two experiments, one (A) carried out with fresh spores, and one (B) with old spores, are quoted in detail.

In the first series of experiments, A, lots of fifteen to twenty bees, obtained from a hive which had been under observation for three years and had never shown any signs of disease, were placed in each of six bell-jars. The materials used for infection were obtained from a hive which had been killed off a few days previously by an attack of *Nosema.*

The first bell-jar contained normal bees, which were fed on syrup. In the second bell-jar was placed a small box in which some of the infected bees had travelled. The bees in the third bell-jar were fed on syrup containing a strong emulsion of spores derived from the chyle-stomachs of infected bees, and those in the fourth bell-jar on syrup mixed with excrement deposited by the infected bees, which contained numerous spores. Those in the fifth bell-jar were given candy on which infected bees had fed, while in the sixth bell-jar a few infected dead bees were placed for two days. The living bees frequently moved the dead ones from place to place.

The results of this experiment are given in the table on p. 83:--

In examining the dead bees, care was taken to distinguish between spores which had been swallowed and were lying in the lumen of the gut, and those which were found, often in large numbers, within the cells lining the alimentary canal. In some instances the bees died with one or two of the cells of the chyle-stomach infected, while in other cases the infection was so heavy that the chyle-stomach was white and almost every cell contained numerous spores. Very heavy infection was noted as early as the fifth day.

These experiments conclusively show that infection may readily occur through feeding with spores and excrement containing spores, and that infection may also be produced though to a less degree by feeding on candy which had been used by infected bees, and by contact with dead infected bees. The experiments with the infected travelling-box are less conclusive, since all the bees

Day after infection.	Bell Jar No. I. Normal Bees.		Bell Jar No. II. Containing infected travelling box.		Bell Jar No. III. Bees fed with fresh spores.		Bell Jar No. IV. Food mixed with infected excrement		Bell Jar No. V. Bees fed on infected candy.		Bell Jar No. VI. A few dead infected bees left in the jar for two days.	
	Dead		Dead		Dead		Dead		Dead		Dead	
1	0	—	0	—	0	—	0	—	2	—	0	—
2	0	—	0	—	2	*Nosema* not found.	0	—	0	—	1	—
3	0	—	3	*Nosema* not found.	0	—	1	*Nosema* not found.	1	—	2	—
4	1	*Nosema* not found.	0	—	1	Few spores in cells.	0	—	0	—	0	—
5	0	—	0	—	4	3 *Nosema* not found, 1 gut white with spores	1	Few spores, etc., in cells.	0	—	0	—
6	0	—	0	—	0	—	1	,, ,, ,,	1	*Nosema* not found.	1	*Nosema* not found.
7	0	—	1	*Nosema* not found.	1	Very heavy infection.	1	*Nosema* not found.	8	No spores seen.	0	—
8	0	—	1	Young stages only.	0	—	1	—	1	,, ,,	2	*Nosema* not found.
9	0	—	5	Young stages in two.	0	—	2	Few spores in both.	0	—	1	Slight infection with spores.
10	0	—	0	—	0	—	0	—	0	—	4	1 heavily and 1 slightly infected with spores.
11	0	—	0	—	0	—	0	—	0	—	0	—
12	4	*Nosema* not found.	6	Some young stages in two.	3	All heavily infected.	4	3 slightly and 1 heavily infected.	1	Very heavily infected.	0	—
13	0	—	1	—	0	—	1	Heavily infected.	0	—	0	—
14	0	—	0	—	4	All heavily infected.	...	... ...	2	One slightly infected.	0	—
15	1	*Nosema* not found.	1	—	...	... ...	...	... ...	...	... ...	0	—
16	0	—	2	Young stages in both.	...	... ...	...	... ...	...	... ...	0	—
17	...	5 killed, no *Nosema.*	0	—	...	... ...	...	... ...	...	... ...	0	—
18	...	5 ,, ,, ,,	0	—	...	... ...	...	... ...	...	... ...	0	—
19	...	... ...	1	Young stages.	...	... ...	...	... ...	...	... ...	0	—
20	...	... ...	0	—	...	... ...	...	... ...	...	... ...	0	—
21	...	... ...	0	—	...	... ...	...	... ...	...	... ...	1	*Nosema* not found.
22	...	... ...	0	—	...	... ...	...	... ...	...	... ...	0	—
23	...	... ...	1	Young stages.	...	... ...	...	... ...	...	... ...	2	1 slightly infected.
24	...	... ...	...	... ...	...	... ...	...	... ...	...	... ...	0	—
25	...	... ...	...	... ...	...	... ...	...	... ...	...	... ...	2	*Nosema* not found.
Total	16	—	22	0 infected with spores	15	10 infected with spores	12	9 infected with spores	16	3 infected with spores	16	4 infected with spores

died before the spore stage was reached. Young forms of the parasite were, however, found in a small number. The percentage of infection varied with the method employed. It should be pointed out that the early heavy mortality in bell-jar No. V. was probably due to starvation, as the candy was very dry and no attempt was made to moisten it. Six of the normal bees were found dead, but no stage of the parasite was found in them.

In another experiment (B) a considerable number of normal bees from the same source as those used in the experiment just quoted were confined in a bell-jar. They were fed with syrup containing an emulsion made by grinding up a number of dead infected bees in water, and filtering the thick fluid obtained through muslin. These bees had been dead at least four months. This experiment was carried out in order to ascertain whether the nosema spores remaining in the dead bodies of bees retain their pathogenic properties.

Day after Infection.	Bees dead.	Result of Examination.
1	0	—
2	0	—
3	0	—
4	1	*Nosema* not found.
5	2	,, ,,
6	0	,, ,,
7	2	,, ,,
8	0	—
9	0	—
10	1	,, ,,
11	1	Some doubtful young forms.
12	0	—
13	1	No *Nosema* found.
14	3	2 contained young forms.
15	2	1 showed young forms, the other, young forms and young spores.
16	0	—
17	0	—
18	2	1 showed young forms in upper part of gut, and in lower, young and old spores; the other was negative.
19	2	1 showed young forms.
20	0	—
21	5	1 showed young forms, 3 showed fairly numerous spores.
22	1	Young forms.
23	0	—
24	7	1 showed very numerous spores, 2 few spores, 2 young forms
25	4	2 very heavy infection with spores, 1 young forms and few spores.
26	4	2 few spores and many young forms, 1 heavy infection with young and old spores, 1 very numerous spores.
27	1	Very heavy infection with spores.
	39	

This experiment conclusively proves that in confinement bees may be infected by means of spores which have remained for some months in the bodies of dead bees. The disease, however, takes longer to develop, for whereas in this experiment intracellular spores were first noticed on the fifteenth day, and very heavy infection was first seen on the twenty-fourth day, in the similar experiment with quite fresh spores just described (Bell-Jar III) intracellular spores were first seen on the fourth day, and heavy infection was first noted on the fifth day.

While similar results were obtained in some of the other experiments carried out under apparently identical conditions, yet in others the results were different. In some cases all the bees died off before spores had developed, though young forms were usually numerous in the last survivors; while in two experiments the bees died rapidly, but neither the young forms nor the spores of *Nosema* were found in the cells of the chyle stomach or elsewhere.

Most of the experiments which have been undertaken clearly show that a fatal infection with *Nosema apis* may be produced in several different ways, especially by feeding with spores, but some of them also seem to indicate that the rate and degree of infection depend on various factors. With the purpose of endeavouring to ascertain to what extent infection is influenced by food and climatic conditions, bees were confined in bell-jars and fed with syrup containing a small number of fresh *Nosema* spores. In some cases, the spores of *Aspergillus niger,* and in others those of *Penicillium,* were added. In both cases all the bees died within twelve days, though not apparently severely infected with nosema. In some of those which were examined the moulds appeared to be growing in the alimentary canal. In order to ascertain whether cold has any marked influence, two lots of bees were kept at different times in bell-jars in an ice-chest after being allowed to feed on syrup containing old spores. After seven days, young forms of *Nosema apis* were discovered in the bees which had died. All were dead in twelve days, but spores were not found in any of these. In other experiments bees were fed on artificially infected honey, beet sugar, &c., without markedly influencing the results of the experiments.

Summary.

The numerous experiments which have been carried out with small numbers of bees confined in boxes and bell-jars appear to demonstrate that *Nosema apis* is capable of producing a rapidly fatal disease. Infection may be produced through the agency of many different kinds of infected materials. The spores which are ingested pass into the alimentary canal, and there lead to the infection of the epithelial cells lining the chyle stomach. Sometimes the bees die before the parasites reach the spore stage of their development, probably owing to malnutrition caused by the numerous young forms growing within the cells. At other times the bees live till numerous spores are produced within the cells. By the rupture of many of the infected cells, numbers of spores are liberated, and pass into the lumen of the intestinal canal. When infection has reached this stage, the chyle stomach presents a milky-white appearance, and sections demonstrate that most of the cells lining it have been destroyed or rendered useless by the development of the parasites within them.

Owing to the fact that some stocks undoubtedly heavily infected with *Nosema* do not suffer from dysentery, while others which are free from *Nosema* show this symptom when placed under unfavourable conditions, Hein thinks that *Nosema* is not the primary cause of dysentery, though he admits that *Nosema*-infected bees are diseased. He thinks that dysentery is due to certain bacteria in relation with the pollen consumed by the bees. In connection with this view, it may be pointed out that dysentery is not a disease, but a symptom, and dysentery in bees may no doubt be produced by many conditions; but this fact is no proof that infection with *Nosema apis* does not often produce it. On the other hand, infection with *Nosema* may be present without dysentery, or even without any marked symptoms. Zander, in fact, carefully points out that diarrhœa is not a constant accompaniment of *Nosema* infection, and that the only essential feature of the disease in the acute form is the sudden extensive mortality among the bees inside and outside the hive.* While it is quite evident from our own observations, the work of other investigators, and the observations of practical beekeepers that the mere ingestion of *Nosema*-infected material is not necessarily followed by infection, yet the experiments we have quoted show that infection usually follows if a sufficient number of spores is given. Other factors are no doubt concerned, as in all other known diseases, but these we have as yet been unable fully to determine, though unfavourable conditions, such as bad weather and confinement, undoubtedly exert a considerable influence. Unfortunately, we cannot claim that most of the experiments which have hitherto been made have demonstrated the pathogenicity of *Nosema*, unaided by bacteria, since the material used for causing infection has contained, not only *Nosema* spores, but also the bacteria found in the alimentary canals of the bees from which the spores were obtained. In those experiments in which spores from bees which had been dead for some months were used, all the non-spore-bearing bacteria were probably dead, and consequently we can conclude that the introduction of non-spore-bearing vegetative intestinal types of bacteria from diseased bees (together with *Nosema* spores) is not essential in the production of infection.

---

* In human pathology classification of disease based on anatomical conditions is being rapidly abandoned as knowledge advances. Pneumococcus, for example, is now known to be the cause of many different kinds of lesions; and diarrhœa may be produced in many different ways; the diphtheria bacillus may produce a typical membrane or a condition simulating simple tonsilitis, or it may be present without producing any lesion.

In spite of the fact that *Nosema apis* cannot be cultivated and obtained in pure culture, we hope to be able to demonstrate pure *Nosema* infection during the ensuing season.

II.—*Experiments on Hives of Bees.*

We have made several attempts to infect hives of bees and to watch the progress of the disease. Though many of the experiments were unsuccessful, some interesting observations have been made.

Owing to the apparently infectious nature of the disease, it was thought undesirable to carry out experiments with hives living under natural conditions. In some preliminary experiments carried out in Scotland in 1910, a wooden hut was built, roofed with corrugated iron. The interior was divided into four compartments, 9 ft. long and 3 ft. 6 in. broad, made by stretching muslin on wooden frames. Each compartment was separated from the next by an air space 2 inches wide. The hut was 12 ft. long, with a door at one end. After entering the door, the observer walked into a space 3 ft. wide extending across the hut. Each compartment opened by a door, fitted with a glass panel, into the observation passage. In order to more effectually prevent bees escaping from the compartments, a muslin curtain formed a second door about 2½ ft. behind the door of each compartment. In July, 1910, a hive of apparently healthy bees, which was known not to have suffered from any disease for several seasons, was placed in each compartment, and fed with syrup every day. On July 30th, 1910, about one hundred infected bees were united with the healthy bees in Compartment I. without any trouble. At this time eggs and brood were present. By the first week of September, eggs and brood were absent, but bees were numerous, and the frames contained sealed food. During the winter candy was given. Though the stock showed no obvious signs of disease, the bees rapidly died in the spring, and all were dead by March 11th. Death was not due to cold or starvation, On examination, the dead bees were found to contain very numerous spores of *N. apis,* showing that a severe infection with this parasite had occurred. The pathogenicity of the parasite was proved by feeding healthy bees with the spores derived from the bodies of the dead bees and producing severe infection (see p. 84).

Compartment II. contained a healthy swarm. Eggs and brood were present on July 20th. On this date two frames of infected bees were added and successfully united. In the first week in September no eggs were present, but otherwise the bees seemed in normal condition. At the beginning of March the bees were suffering from dysentery, and many had died. The stock died off by the end of March.

On examination of the dead bees spores of *N. apis* were found in moderate numbers, showing that this stock had also been affected.

Compartment III. contained a large swarm of hybrid bees, to which apparently infected bees were united on July 30th. The bees remained well and active for some months, but ultimately died, apparently from starvation, as on examination at the beginning of April the food was found to be exhausted.

Spores of *Nosema apis* were not found in the dead bodies.

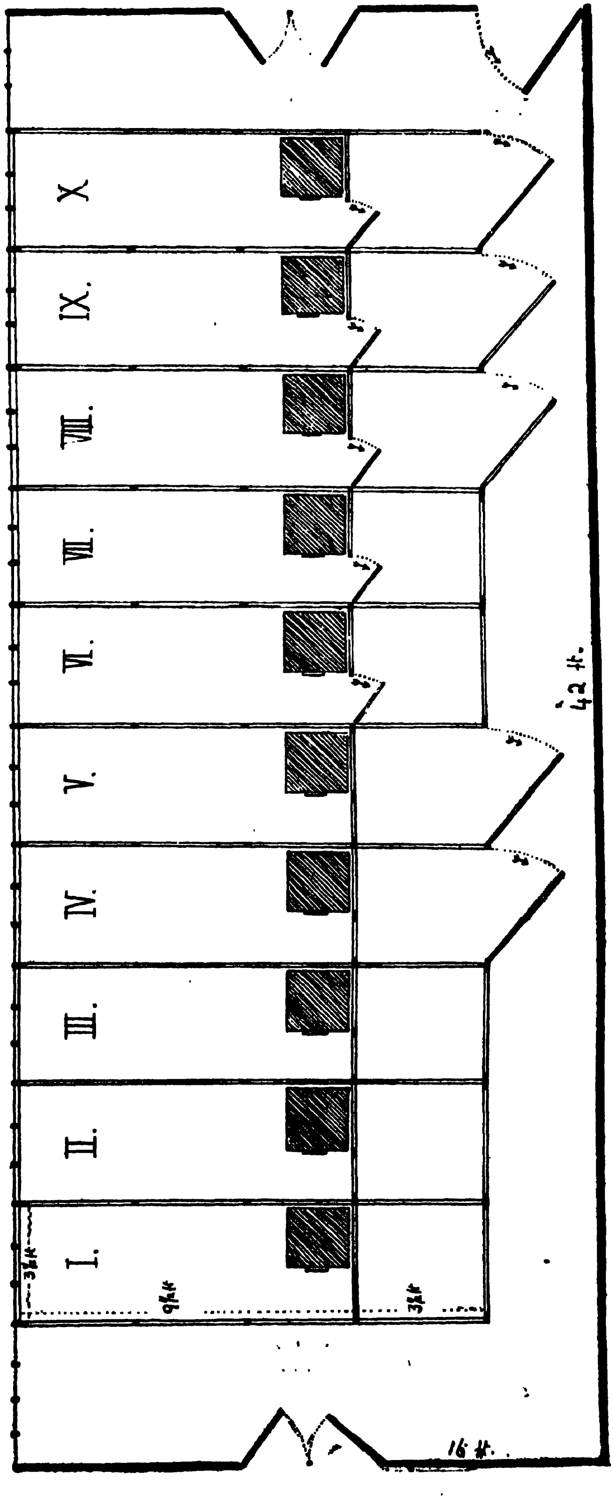
Compartment IV. contained healthy bees as controls. This stock remained strong and well till the middle of March, after which they gradually died off, probably because no brood had been raised.

Nosema apis spores were not found in the dead bodies.

These experiments showed that intense infection might be brought about by uniting infected bees with healthy bees. Unfortunately, it was impossible to make examinations at frequent intervals in order to trace the rate of infection.

Stocks kept under the conditions described tend to die off, since egg-laying ceases after some weeks, and consequently the bees which die are not replaced by young ones.

In consequence of the success of these preliminary experiments, it was decided to conduct somewhat similar experiments at Cambridge during the season of 1911. For this purpose a large shed was constructed, 42 ft. long and 16 ft. broad, entered by a door at one end. Windows which could be opened for ventilation were provided at each end, as well as a long ventilator running the whole length of the gabled roof. An observation passage 3 feet 6 inches wide ran down the left side and along each end. The rest of the space was divided into ten compartments each 3½ feet wide and 9¼ feet long. Muslin supported on wooden frameworks formed the sides and roof of each compartment, which was separated



Ground Plan of Hut in which Experiments on Hives of Bees were carried out (*see page* 88).

from the next by an air space three inches wide. The lower two feet of the walls were lined with oiled paper so as to prevent dirt and other material passing from one compartment into the next. Each compartment opened by means of a door into a muslin-lined chamber three feet long, which opened by means of another door into the inspection passage. The chamber was intended to prevent the escape of any bees which might happen to pass through the first door. A long window ran the whole length of the side of this house on which the compartments were placed, but the bees were prevented from getting on to the windows by means of muslin stretched in front of the glass, and about two inches from it. In each compartment the hive was placed near the entrance door.

The arrangement of the compartments can best be understood by reference to the ground plan (see Ground Plan on preceding page). A photograph of the house is shown in Plate V.

For experimental purposes six apparently healthy stocks, which had been free from any known disease for some seasons, were obtained and placed in six compartments.

The stocks were placed in the compartments on May 18th, and were fed on syrup. During the first two days of confinement varying numbers of bees died, but after a week very few bees were found dead during routine examination. All the dead bees were frequently removed. Stock No. I was kept as a control without any attempt at infection. The stock gradually diminished and finally died out on July 17th. The bees which died towards the end of June and in July were examined, but *Nosema apis* was not found.

Stock No. II was given sealed stores from a badly infected stock. The stock gradually diminished and ultimately died out early in October. Neither spores nor young forms of *N. apis* were ever found.

A frame of young sealed brood from a badly infected stock was placed in the hive occupied by Stock No. III on May 26th. This stock remained apparently healthy up to the middle of August, but after that time the numbers gradually diminished and the stock died out by October 30th. Young forms of *N. apis* were found in a small proportion of the bees which died after September 18th, but spores were not found in any of them.

Stock IV was fed on June 2nd and 8th on syrup containing numerous old spores derived from bees which had died of infection with *N. apis*. Spores which had been ingested were found in the intestinal contents of those which died within the next few days, but only on rare occasions were intracellular forms of the parasites found. On July 17th they were supplied with a frame of healthy

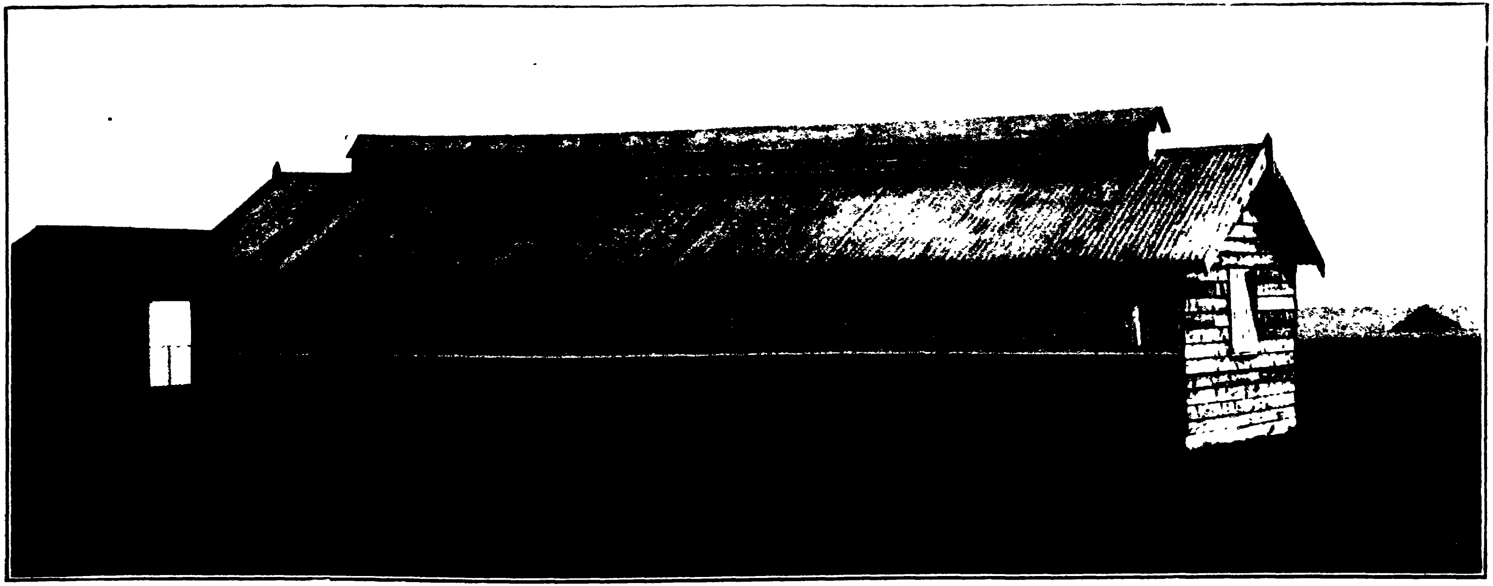


PLATE V.

Photograph of hut in which Experiments on Hives of Bees were carried out (*see* pp. 88–89).

food, but otherwise were fed on syrup and, later, on candy. The stock was doing well on December 8th. On examination in the middle of February the stock was found to be dead. The hive was much soiled with dysenteric material, in which *Nosema* spores were plentiful.

On May 29th a number of adult bees from an infected hive were united with Stock V. This stock gradually dwindled and died out by October 12th, without any evidence of infection with *N. apis* being obtained.

Stock VI was kept as a control. It did well up till the end of July, but after that time failed and died out by October 17th. No evidence of *Nosema* infection was obtained.

These experiments were not altogether satisfactory for several reasons. It was found that the queen soon ceased to lay eggs, and consequently after a few weeks no young bees emerged to take the places of those which died in the ordinary course. The bees also became listless and frequently hung in swarms round the windows and did not return to the hives. It was found that the only method of promoting breeding was to add frames containing honey and pollen, but unfortunately this fact was observed too late for arrangements to be made for a continual supply of healthy sealed food.

From one point of view, however, these experiments are not without interest and importance. Although the apparently healthy bees were thought to be free from *Nosema* infection, the examination of specimens shortly after their arrival proved that *Nosema apis* in very small numbers was present in some of them. These bees were obtained from the apiary near which the preliminary successful experiments were carried out the year before. By some means they had become infected—though whether from some neighbouring stock or from the experimental stocks cannot be decided—previous to being brought to the experimental hives at Cambridge. The infection was very mild in character, for none of the stocks in this apiary have since shown signs of infection. Whatever the source of infection, some immunity seems to have been conferred, for the stocks of bees used in the preliminary experiments in 1910 undoubtedly became heavily infected, and spores obtained from their bodies some months after death caused severe infection in one of the experiments on a smaller scale, which has already been quoted (p. 84). In spite of the undoubted pathogenicity of these spores, they caused no immediate outbreak of the disease when fed to Stock IV, though severe infection occurred several months later.

If the unsuccessful results of some of these experiments are rightly ascribed to the immunity of the experimental bees, owing to previous slight infection, an observation of considerable importance has been made, which will have to be confirmed by subsequent experiments.

Besides the experimental hives, some diseased stocks were obtained and kept for observation in separate compartments.

Stock VII was obtained from Hertfordshire. It had shown signs of Isle of Wight disease for some weeks, and many of the bees had died. This stock was placed in a compartment on May 8th. The next day many dead bees were found. On examination many of these were found to contain *Nosema* spores, as well as young forms. A number of bees died daily, and all had died by June 8th. Although many dead and dying bees were examined at various times, no cases of severe infection with spores were found. The majority, however, showed a high degree of infection with young stages. Spores were found in the cells of the combs taken from the hive after the bees had died.

Stock VIII was obtained from Scotland. Specimens from this stock, which had been sent to us previously, were severely infected, large numbers of spores being found in the cells of the chyle-stomachs of many of the bees, and the stock was rapidly diminishing in numbers. When placed in the compartment the bees covered four frames, and young in all stages and sealed food were present. In the first week of confinement a number of bees died and all stages of *Nosema apis* were found in them. Then the mortality ceased, and up to the end of July the stock showed no signs of disease. During August and the early part of September many bees died, and by September 29th only about 200 bees were alive. By October 3rd all the bees were dead. Bees dissected during July showed no spores and only occasional young forms. Those examined in September, when the stock was rapidly dying off, showed both young forms and spores. This stock seemed to show a partial recovery. Stock IX was placed in a compartment on June 23rd. Young forms and a few spores were found in some of those which were dissected. In a few days the mortality ceased and the stock remained apparently healthy till the middle of July. After this time many bees died, and the stock died out about the end of September. During the last month young forms were frequently found, but no spores were present in the dying bees.

The queen was removed, killed and dissected on September 14th. Young forms were found in the cells of the chyle-stomach, but no spores. Spores were found in some of the cells of the comb.

Stock X, which was only slightly affected, was placed in a compartment on July 18th. A small proportion of the bees which were examined showed young forms in the cells of the chyle-stomach. Spores were not observed. In a month the stock gradually diminished, but later young forms were found in small numbers. The stock seemed to be well till the beginning of October. After that time the numbers rapidly diminished and the stock was dead by December 17th. Many spores were found in the dead bees.

Conclusions.

These observations show that in captivity the disease is characterised by quiescent periods, during which the affected stocks show no symptoms. Sooner or later, however, the symptoms again make their appearance and the stock dies out. During the quiescent period, the parasites can only be found with difficulty, many bees having to be examined before an infected one is found. In connection with this fact the observation made on humble bees is of some interest (p. 132).

So far as the authors are aware, very few attempts have been made to keep bees in confinement for prolonged periods during the summer months,* and when planning these experiments they foresaw that many difficulties would be encountered, and that the observations made under these artificial conditions would probably not be entirely satisfactory. Since, however, the artificial infection of normal hives could not be undertaken owing to the risk of disseminating the disease, they were forced to make their observations on bees in confinement. All the stocks kept in these compartments behaved in the following way. The bees roamed round the windows during the first day or two, and many died. Within three or four days the heavy initial mortality ceased, and the bees returned to the hives. The queen gradually ceased to lay eggs, and consequently very few young bees hatched after some weeks of confinement. When the queen began to lay few eggs, the bees became listless, and many of them failed to return to the hive at night. A few bees died daily, and since the number of young bees hatched was insufficient to replace those which died, the stock gradually dwindled and finally died out. The listlessness was such that it was necessary to remove the dead bees from the hives, and also to work constantly at the removal of the lesser wax moth. The bees did not appear to be interested in anything. We have found only one method of preventing this sequence of events, namely, by supplying frames of food from healthy hives. Unfortunately, this fact was discovered late in the season, after trying other expedients to maintain breeding which did not necessitate the use of food which had been in contact with other bees. We were then unable to obtain a sufficient supply of frames of normal food. In future experiments, however, we hope to be able, by keeping healthy stocks close to the experimental hut, to give a constant supply of food-frames. Probably the inactivity of the bees and consequent diminution in the metabolic processes exerted an influence on the growth of the parasites and produced conditions rarely met with under normal circumstances.

---

* Maassen's experiments are quoted in Section VII, p. 109.

SECTION VII.

THE WAYS IN WHICH THE DISEASE MAY BE SPREAD.

By G. S. GRAHAM SMITH, M.D., and G. W. BULLAMORE.

In this section we propose to discuss the ways in which the disease may be transmitted from individual to individual, from hive to hive, and from apiary to apiary. As far as possible, our arguments are based on such observed facts in the life-histories of bees as seem to us to be likely factors in aiding the dissemination of the disease. On some points no direct evidence has yet been obtained, and in regard to these we must rely on the known habits of bees; on some we have the evidence afforded by observations on diseased stocks, on some we have the direct evidence afforded by the finding of *Nosema* spores, and on a few we have the conclusive evidence afforded by successful infection experiments. As far as possible, we have endeavoured to discuss each probable mode of infection separately, though it is evident that, owing to the close relationship that exists amongst these insects between the individual and the community, once the disease is introduced into the colony the infection may be spread by many different methods.

Except in regard to experimental infection we have had few opportunities of making observations on diseased stocks for ourselves, but a mass of valuable information has been supplied by the Board of Agriculture and Fisheries, which has not only placed at our disposal all its correspondence relating to this disease, but has supplied us with the reports of its experts on the disease in many severely infected districts. Many bee-keepers have kindly sent exhaustive reports relating to the disease as it affected their apiaries, and have from time to time supplied us with materials for investigation, and, moreover, have given us all the information they could collect respecting the progress of the disease in their districts. We have thus enjoyed exceptional opportunities of obtaining information on the disease in most of the affected districts.* Our special thanks are due to Mr. T. W. Cowan, who has kept us informed on the progress of investigations on the Continent, and has supplied us with copies of the more important Continental publications.

---

* Except where otherwise stated, the quotations we have made are from the sources mentioned.

A.—Infection through the Agency of Food Materials taken into the Hive.

(1) *Water.*—Whilst it is universally admitted that bees require water, but little information is given in most of the books we have consulted as to the times at which the greatest quantity is consumed, or as to the places from which it is collected under various conditions. Before proceeding to discuss the importance of water as an infecting agent, we have, therefore, endeavoured to summarise the more important observations which have been made on the use of water.

Water seems to be required by bees at all times when they can leave the hive; only sufficient, however, is brought in to serve the needs of the colony for a short time. *Pettigrew* (1870, p. 58) says that "in the spring months water is extensively used in hives, and long before comb-building commences. A very great deal of water is carried into a hive in the height of the breeding season. It is collected in dewy mornings, and after showers, from the blades of grass and leaves of plants. In the absence of showers and dew, bees resort to brooks, rivers, and water-tubs for it. During inclement weather, when not a particle of honey can be obtained, bees often venture out for water. In dry seasons we have often seen them suck it out of soil that has been artificially watered." Possibly at certain periods of the year, when sufficient nectar is being gathered to supply the daily wants of the colony, the bees want less water, if any at all, besides that which the nectar affords them.

As long ago as 1849, *Miner,* in America, found that a great decrease in the use of water from pans took place in June, and he says that "this decrease in the use of water was coeval with the decrease in the production of larvæ." It is generally thought, as Pettigrew states, that "the sight of bees seeking and sipping water is a proof that breeding is going on in their hives."

A recent estimate (discussed in "Gleanings," 1911, p. 744) gives 40 lbs. as the weight of water carried into the hive in a year. Although this estimate is possibly too high, the figures show that there is a very great demand for water. Whatever may be the precise quantity of water used, it may be regarded as certain that bees make use of large quantities of water in the spring months. In the summer probably less water is collected, but the deficiency is made good by the fluid character of the nectar. In regard to this, *Cheshire* (Vol. II, p. 405) says that "while honey is coming in, it provides the requisite water for forming the diet of the larvæ."

Water is obtained from various sources according to the condition of the weather. When the weather is dry, the bees resort to streams and pools, certain selected spots being generally made use of. In this connection one fact of considerable importance should be borne in mind, namely, that "bees often resort to dirty pools of stagnant water, rather than take clean but colder water." In showery weather, on the other hand, they may be seen taking water off paths and damp earth in the vicinity of the apiary, especially when it has been warmed by the sun. Even in very wet weather bees will venture out of the hive to obtain water.

When brought into the hive, the water is temporarily stored in some of the cells, and used by the nurse bees in the preparation of the larval food.

Although, as far as we know, the spores of *Nosema apis* have never been demonstrated in water supplies, we think that the great demand for water and the sources from which it is collected are important factors in the spread of the disease.

In dry weather infected bees which are not too weak to fly probably often visit the watering-places frequented by several stocks, and may infect these places, especially stagnant pools or artificial troughs, either by depositing infected excrement in them or by falling into them. Healthy bees carrying infected water to their hives may thus infect themselves and the hive to which they belong.

In showery weather water is probably a greater source of infection than in dry weather. The bright intervals which permit the gathering of water are also utilised for cleansing flights by many of the bees. Consequently, the ground and plants in the vicinity of the apiary become soiled with excrement. Since the excrement of infected bees is often full of spores, many of the puddles and drops must be highly contaminated where infected bees are present. As we have seen, the bees in such weather do not trouble to resort to the usual watering places, but utilise any water they can find. Opportunities are thus afforded for gross infection, not only of many of the foragers from adjacent stocks, but also of the water which is utilised within the hive.

Zander is of the same opinion, for he says that by cleansing flights the whole neighbourhood is sown with spores, and so the pest can attack other stocks. He regards the liquids in which bees drop their excrement as especially dangerous. In another part of his paper he again calls attention to the danger of infection from water, and gives an example. From his experience he considers that drinking in the open is especially dangerous.

> "The bees are thirsty in spring, and seek to satisfy themselves in every place, appetising or not. In particular, drinking from stagnant water, metal vessels containing moss, pebbles, &c., in which the water is not constantly renewed, must be regarded as a likely source of infection. Dead bees, as we have seen, often lie in vessels whose contents become fouled with excrement, so the bees are in great danger of receiving spores into the intestines. The enormous losses from *Nosema* in certain apiaries were due, as I believe, entirely to a small fish-pond in the garden of the Zoological Institute. Its shallow water soon got warm, and it was covered, especially in spring, with green algæ, which gave the bees an easy opportunity of drinking. Since the pond was removed, there has been a great diminution in the disease."

In this connection another observation of some interest may be quoted. The bees of an apiary situated in a highly infected district remained healthy. It was found that they were in the habit of gathering chemically polluted water from the effluent of a gas-works. The disease only appeared amongst them when, owing to alterations, they were compelled to gather water from other sources.

(2) *Nectar.*

> "As soon as the days are warm enough the bees begin to fly from the hive in search of the earliest spring flowers. From these flowers they collect the nectar. The nectar is taken by the bee into the mouth, and then passes to an enlargement of the alimentary canal known as the honey stomach, where it is acted on by certain juices secreted by the bee. The true stomach lies just behind the honey stomach, and if the bee needs food for its own immediate use, it passes on through the opening between the two stomachs. On its arrival in the hive, the bee places its head in one of the cells of the comb, and deposits there the nectar which it has carried in. By this time the nectar has been partly transformed into honey, and the process is completed by the bees fanning the cells to evaporate the excess of moisture which still remains; when the cell has been filled in with the thick honey, the workers cover it with a sheet of wax, unless it is to be eaten at once. The collecting of nectar continues throughout the summer whenever flowers are in bloom, and ceases only with the death of the last flowers in the autumn" (*Phillips*, 1910, p. 6).

Miller (i., 1912) noticed in observatory hives that the bee returning from the field with a load of nectar

> "does not rush for a cell to put it in; on the contrary, she spends a seemingly endless amount of time wandering about and inspecting the cells. When at last one is found that seems satisfactory, she enters it feet up and back down. If the cell is empty, she puts her mouth into the upper and rearmost angle, opens her mouth and mandibles, and at once a drop of nectar is seen to well up until

it touches the cell. Slowly the head is turned from side to side, spreading the nectar against the corners of the cell. All the time the mandibles are kept in motion as if biting, though the lips do not meet. The outflowing nectar fills the mouth, flows up over the upper lip (labrum), and fills the space between the mandibles. When the bee has emptied her sac, she backs out of the cell."

During the process described, any contaminated material about the mouth and mandibles would probably get into the nectar. Saliva also is poured into the nectar.

On this subject *Browne* (1908, p. 11), who has made numerous analyses of nectar and honey, says:

> "In the modification of the nectar by the bees several changes in composition are produced. Amongst the most important of these is the evaporation of the nectar to a water content of about 20 per cent. This is effected in the hive by the bees exposing the nectar in thin layers to a current of air produced by the fanning of their wings. This evaporation is still further hastened, according to some, by a process of regurgitation, the nectar being continually thrown out from the honey sac on the partly doubled tongue, and then drawn in again until, by the movement of the air and the heat of the hive, the nectar is sufficiently reduced to be deposited in the cells of the comb."

So far as we know at present, the gathering of nectar is not an important factor in infection. Infected bees which visited a flower might possibly contaminate it with spores, and in this way other bees visiting the flower might become infected. Zander seems to think that infection may occur in this way. Lilac flowers and gooseberry flowers, when the bees were so busy with these blossoms that they neglected others, have been found covered with excrement containing spores (p. 121). Spores have been found in the honey stomachs of naturally infected bees, and in the cells of combs, but we have as yet obtained no definite information as to their source. If the last sentence quoted from Browne is correct, one mode of infection of the honey cells from infected bees is explained.

(3) *Pollen.*—Bees collect pollen from various flowers, and it is often said that a bee visits one kind of flower only during a single excursion. *Betts* (17, xi, 1910), however, examined 1,589 loads of pollen during the year, and found that mixtures of pollen were present in 144 (9 per cent.). The methods adopted in collecting and bringing back the pollen have been carefully described by Cheshire and others, the most recent account being that of *Sladen* (14, xii, 1911). Since the exact methods employed do not seem to be of importance in *Nosema* infection, we do not propose to describe them in detail. "On entering the hive, the foragers remove the gathered masses of pollen by means of the legs, and

deposit them in a cell. Very soon after pollen is thus deposited, nursing bees come and mash it down into a hard cake. We have not been able to discern how" (*Root*, 1910, p. 331).

It seems highly improbable that infected bees should be able to contaminate the pollen of the flowers they visit, and thus cause healthy bees which visit these flowers to become infected. Consequently, we are inclined to think that infection is seldom carried into the hive with the pollen. If, as is thought by some (*Root*, 1910, p. 328), "the tongue is an important organ for gathering pollen grains," the latter may be contaminated by infected bees before they are stored. In several instances *Nosema* spores have been found in the pollen cells of naturally infected combs.

Though we are of opinion that infection by means of pollen is of rare occurrence, we think certain kinds of pollen may be instrumental in causing the symptoms to assume a more aggravated form in hives which are already affected. Owing to the fact that the colon is often found distended in bees (see p. 32) suffering from this disease, *Imms* (vi, 1907), and other investigators after him, thought that the symptoms were due either to the ingestion of too much pollen or to the irritating qualities of certain pollens. As *Malden* (1909, p. 816) pointed out, however, distension of the colon is not a characteristic sign of the disease, for it frequently is not present, and "all the variations in the condition (*i.e.*, distension) of the alimentary canal met with in the diseased bees can be seen in healthy bees under various conditions." The reasons for the distension of the colon at certain times is given later (p. 101). Several writers have ascribed the disease to the unsuitable qualities of certain pollens or honey—buckwheat honey, heather honey, charlock honey, &c.—or have stated that bees nurtured on them are frequently found dead in the spring.* The experiments of Maassen, which are fully quoted elsewhere (p. 109), shows that stocks which are slightly infected but show no symptoms may be induced to show severe symptoms if kept in confinement at 16° C. We think it probable, though as yet we have no experimental evidence to support this view, that the ingestion of unsuitable pollen or honey may act in the same way, and lead observers to think that the unsuitable food was the actual cause of the disease. Mouldy pollen and watery honey, and perhaps the lævulose (*Root,* 1910, p. 78) from granulated honey, may also act in the same way.

---

* On this subject great differences of opinion exist. In regard to heather honey, *T. D. N.* (1912, p. 47) says, "no winter food could well be worse," whereas *A. W.* (1912, p. 66) says, "this is entirely contrary to my experience and that of other successful bee-keepers *in this neighbourhood.*" The following interesting extract may be quoted in this connection. "Pollen is very abundant in the bottom of cells containing heather-honey. Hives so conditioned are in the best order for breeding, but when the pure honey becomes exhausted bees take to honey and pollen for food, hence the fatality of so many bees this year. Many cases of so-called dysenteric hives during winter are but the result of bees eating pollen in scantily honeyed hives.

"For many years I have been recommending bee keepers to feed liberally with sugar syrup all heather-hives. So conscious were our forefathers of this that they made it a rule never to take a hive to the heather intended as a stock hive, although they knew well that heather-hives were the best breeders in spring if they passed the winter ordeal unscathed" (*Lanarkshire Bee-keeper*, 1894).

(4) *Other Substances Collected as Food.*—Honey-dew, the produce of aphides, or plant lice, and coccids, or scale insects, is often collected by bees in large quantities. Under some conditions this may act in the same way as the unsuitable foods just mentioned.

B.—Infection Within the Hive.

Having briefly discussed the means by which *Nosema* infection may be introduced through the agency of food materials brought into the hive, we propose to consider the ways in which the infection may be spread within the hive. Infected water stored in the cells is used by the nurse bees in the preparation of brood food. In this way infection of the nurse bees may be brought about. Although we have occasionally observed infection in young bees, we cannot at present give any definite information as to the time at which young bees are liable to become infected. On this subject Maassen remarks that though the parasites are found both in young and old bees, they are never found in newly hatched bees.

Once infected bees have entered a hive, or infected material has been carried into it, there are many ways in which the disease may be transmitted to a large proportion of the stock. Infected water temporarily stored in the cells is made use of by the nurse bees. which may thus become infected without leaving the hive. Pollen and honey, both of which may contain spores, are used at various times by young bees, and perhaps sometimes by old bees. Both are ingested in large quantities by the young bees and taken into the chyle-stomach, where they are converted into chyme. *Snodgrass* (1910, p. 100) discusses very fully the various views on the preparation of the brood food, and comes to the conclusion that little is known about the process. Regurgitation of the food or chyme ,after preparation in the stomach may take place, in which case ingested spores would probably be present in the chyme. "This chyme the nurse bees feed to the brood and also to the queen and the drones" (*Root,* p. 10). During this process nurse bees, drones, and queen may all become infected. In the case of the young bee, the colon becomes distended with pollen husks, and remains in a distended condition, especially in the spring, till the insect can take a cleansing flight. Possibly it may occasionally be forced to deposit its excrement in the hive. In either case, if the bee has been previously infected, and spores have been developed, other bees may be infected either inside or outside the hive by means of the spore-laden excrement. Older bees confined to the hive by bad weather become similarly distended, as we have proved by experiments on a normal hive. This physiological distension has been at times regarded as a sign of the disease. "During the winter the stores of honey are consumed, and generally in the spring but little remains," consequently during the winter months nearly all the spores which have found their way into the stored honey have the chance of infecting the bees which consume them.

Observations have shown that on occasions food is passed from mouth to mouth. The evidence as to the extent to which this habit prevails at different times and under different conditions is conflicting. The statement has been repeatedly made that bees returning laden with nectar do not deposit their loads directly in the cells, but pass them to young bees in the hive and that these in turn deposit the nectar in the cells. *Miller* (1912), as the result of work conducted with observatory hives, considers that a nectar-laden bee never yields any of it to other bees in times of plenty, though when the colony is starving some bees do sometimes obtain food from returning workers. If the habit of passing food from bee to bee is at any time extensively practised, it must have a considerable influence in the spread of the disease within the hive. The habit of cleansing and licking each other must also materially contribute to the spread of this disease.

It is well known that bees remove dirt and refuse from the hive, a process in which the tongue is largely used. Zander has noticed that some infected bees, if disturbed, very readily discharge small quantities of fæcal matter full of spores. This is removed by others, which in consequence become infected. Zander, in fact, regards this mode of infection as extremely important. When the disease assumes the dysenteric form the interior of the hive, especially when the bees are unable to get out, may be greatly soiled with fluid excrement, resulting in the infection of all the healthy members of the colony which endeavour to clean the hive.

The process of comb-building has been studied by many different observers, most of whom are in agreement on the points which are of special importance in connection with the disease, namely, that the process of wax production is exhausting, that the bees "are fed on an abundance of honey" (*Snodgrass,* 1910, p. 72), and that the wax is passed from mouth to mouth:—

"The small flakes of wax are passed from mouth to mouth, there mixed with a salivary secretion to make the wax pliable, and then are placed in the top of the hive by the first comb builders" (Phillips, 1910). "One bee after a seemingly endless lot of fussing will add a bit of wax to the growing comb, and soon after another bee will remove it and apply it elsewhere" (*Miller,* 1, xi., 1911, p. 664).

During the processes just described, infected bees, if working, must be very liable to contaminate the wax with spores, which may either infect the bees subsequently dealing with the wax, or may remain in the cells and ultimately infect any materials placed in them. The consumption of large quantities of honey which may be infected, and the exhausting nature of the process, probably also aid in the spread of the disease, the latter by impairing the natural resistance of the bee to the attacks of the parasite.

As already mentioned, both the queen and the drones are probably infected by the food given to them by the workers. Infected drones may transmit the disease by soiling the hive with infected excrement (*Langstroth,* 1907, p. 88), or in the act of feeding may perhaps communicate the disease to the workers which feed them, and possibly, as explained later, they may occasionally carry the disease to other stocks. As yet, however, we have little definite information on the influence of the drone in the spread of infection.

The infection of the queen is a much more serious matter, though in her case it seldom leads to a rapidly fatal result. This fact is scarcely surprising, since we know that the queen lives for some years, and survives many generations of workers. The queen deposits her excrement in the hive, and this is removed by the workers; consequently, when the excrement of the queen contains infected material many of the scavengers are liable to become infected. So far as we are aware, no cases of infection of the ovaries or genital tracts have been recorded, but the eggs may become contaminated when they are being laid. Neither the larvæ nor the freshly hatched bees, however, usually show signs of disease. Up to the present, therefore, we have no evidence that hereditary infection plays an important part in the spread of the disease.

C.—Spread from Hive to Hive.

Some of the ways in which the disease may be conveyed from hive to hive have been discussed in the previous pages, such as by means of contaminated common watering places or pans, or the soiling of the ground in the neighbourhood of the hives by infected excrement. The latter is probably one of the most common means by which the disease is conveyed from hive to hive, and explains the haphazard way in which closely situated hives show the infection. We have been supplied with several plans showing how the disease has progressed in different apiaries. In many cases the irregular sequence in which the hives showed symptoms was a marked feature, though in others it appeared to travel from one hive to the next.

(1) *Interchange of Adult Bees.*—A mode of infection, probably of considerable importance, is by bees, especially parasite carriers, entering wrong hives. Both worker-bees and drones are reported often to go into hives other than their own, and to live in these without molestation. This fact is more noticeable when hives of Blacks and Italians are kept side by side.

"Bees which blunder into the wrong hive, as they return from the fields filled with honey sacs, are seldom attacked" (*Buttel-Reepen,* 1907, p. 6). It appears that occasionally bees in large numbers enter the wrong hive, as described by *Buttel-Reepen* (p. 10):—

> "I noticed one day a change in two hives standing close to each other. Colony 'A,' in which a vigorous increase was to be expected, showed a constant diminishing of numbers, while colony 'B' strengthened in a surprisingly short time. By good fortune, colony 'A' was of the native home variety, and colony 'B' a yellow Italian hybrid. The colour distinction of the varieties brought the explanation in this case. It was soon seen that colony 'B' was taking up the young from the other hive. . . . I noticed after some time that the young Italian bees always took their flights of orientation earlier than their neighbours; now, when a little cloud of these young bees, humming loudly, would be flying in front of colony 'B,' the native colony would gradually begin to send out bees for orientation, but its mass of humming bees was always considerably smaller. This was because many bees, attracted by the loud humming, immediately plunged into the neighbouring tumult, there oriented themselves, and accordingly entered colony 'B' thereafter. These were accepted on account of their indifferent odour, and chiefly, perhaps, because of their entirely 'harmless conduct.'"

In speaking of drones, the same observer says that the drones, which are extremely cosmopolitan, loaf about from hive to hive, and in consequence apparently of their specific odour, are received peacefully everywhere, provided, of course, that the killing of drones has not yet begun. We noticed in some infected stocks (Section IV, Nos. 3, 16, 20) that the drones were the only bees in which spores were found, possibly an observation of some importance. As the drones are usually turned out earlier by diseased than by healthy stocks, they may sometimes find a resting-place in a strong stock and take the disease with them. Drones are known to fly long distances, perhaps two miles (*Root*, p. 143), but we have at present little information as to whether they enter hives so far away from their apiaries. A fact of great importance is that bees belonging to weak colonies, which are possibly suffering from the disease, are often attracted to strong colonies, and may carry the infection with them. Sometimes the contrary is the case, for *Mathewson* (1, ii, 1912) says: "At the time of setting out be sure to put all light-weight colonies in the *front* row of the yard; the stray bees from the yard will help to build them up better than any manipulation I ever heard of."

(2) *Robbing.*—In many reports which we have read mention was made of the fact that strong hives robbed those which were weak and showing symptoms of the disease. In some cases the robbers seem to have remained in good health, but in many they shortly afterwards succumbed to the disease. Mr. H. M. Cooper (cited by *Malden*, 1909), for example, says:—

> "I have seen scores of cases where robbers have caught it almost directly and have been dying off rapidly in about a fortnight, and in two or three cases swarms have entered diseased hives, and have all been dead in from twelve to eighteen days."

Whether symptoms appear amongst the robbers after robbing an infected hive probably depends on several factors. If the robbed colony is suffering, or was recently suffering, from dysentery, the combs are probably highly contaminated, and consequently the chances of infection are greatly increased. On the other hand, if the combs are clean and few spores present in the honey, the probability of severe infection is decreased. Further, it is known that the survivors of a colony too weak to resist the robbers are apt to join the latter, and, being themselves probably infected, are likely to aid in the transmission of the disease. When hives whose occupants have died some time previously (*e.g.*, in the winter) are robbed, it is probable, judging from our experiments (p. 92), that some weeks will elapse before the symptoms appear amongst the robbers.

(3) *Swarms.*—It has been noticed that swarms from strong colonies very frequently develop the disease, and not infrequently the parent stock shows symptoms even earlier. One or all of the following factors may be concerned in producing this condition.

> "The bees, before leaving their old hive, fill themselves with honey until the abdomen is greatly distended, and for this reason it is not necessary for them to collect nectar for a day or two, for they have other work to do" (*Phillips*, 1910, p. 11).

If the honey in the old hive is to some extent contaminated, excellent opportunities for infection are afforded, both owing to the quantity eaten and the abnormal conditions which prevail both during and after swarming.

If any "parasite carriers" happen to be present in the swarm their condition is probably aggravated, so that they frequently void small quantities of excrement (see p. 32) and infect the occupants of the new hive. Parasite carriers may join the swarm from three sources: from the parent hive, from neighbouring hives, and from distant hives by means of field bees. It appears to be well established that a swarm excites and often attracts any bees that may happen to be in the neighbourhood. That many of the bees which are attracted remain with the new stock is shown by the fact that when stocks of Italian bees are in the vicinity of a swarm of black bees, numbers of Italians are found with the swarm after it is hived. The distances which foraging bees travel no doubt vary in different localities and at different times, but are known sometimes to be considerable. *Doolittle* (15, i, 1912, p. 40), in the course of some interesting remarks, states that bees often work from two to five miles away. Possibly some varieties will go further than others, and there is evidence to show that the type of country influences the range of flight.

> "Where bees can fly from a hill over a wide valley, so as not to encounter woods, they go much further than over a perfectly level country. We have travelled over a very large portion of the United States where bees are kept, and wherever we have gone we have asked the question, 'How far do bees fly?' For level country the general response is, 'Not more than a mile and a half; usually not more than a mile.' While bees will, of course, fly further, the claim is made that they do not work to advantage. In hilly country such as we find in New York, bees will sometimes fly for miles to gather buckwheat honey. This has been demonstrated very conclusively at the Alexander apiary, at Delanson, N.Y., and in other places in that State, where we have travelled." (*Doolittle,* 15, iii., 1912, editorial note on).

Parasite-carriers working at considerable distances from their hives may perhaps sometimes join swarms, and transmit the disease. On this point, however, we have as yet been able to obtain no definite information.

Sometimes when the queen's wings have been clipped, or she is prevented in some way from leaving the hive, the bees which are preparing to swarm may join other swarms. *Root* (p. 2) gives an instance in which a large number of Italian bees joined a small cast in a neighbouring apiary under these circumstances.

The bees left behind in the old hive, if slightly infected, or partially immune before swarming, may develop typical symptoms, the disease being aggravated by the excitement of swarming and the subsequent work.

Many instances have been described of stray swarms being caught and shortly afterwards developing the symptoms of the disease. Occasionally the disease has been started in an apiary in this manner.

Swarms sometimes travel several miles, and in some cases may have been responsible for the introduction of the disease into non-infected areas. Excessive swarming which occurs in some years must be an important factor in the spread of the disease. In 1906–7,* for instance, throughout the south of England swarming started early in May and continued until autumn.

(4) *The Occupation of Old Hives.*—Some observers have stated that swarms obtained from healthy apiaries and placed in old hives, in which the former occupants had died of the disease, showed symptoms after various lapses of time, and eventually died out. Sometimes the symptoms developed within a few days or weeks, but sometimes the bees remained healthy for months and then developed the symptoms. Other observers, as would be expected, have quoted cases in which no symptoms have developed.

We know that spores may be found in the hives which have been occupied by diseased bees, and our experiments have shown that healthy bees placed in travelling boxes used by diseased bees may become infected. Our experiments have further shown that when old spores are used for infection experiments, a long interval elapses before the symptoms appear. It is therefore not difficult to understand that old hives may be a source of infection and that the appearance of the symptoms may be retarded. When months elapse before the symptoms are noticed, possibly the following sequence of events takes place. Owing to the paucity of spores, a few bees only become infected, and the parasites develop slowly. From these others are infected, but the colony remains apparently healthy till unsuitable conditions favour the general development of symptoms. One of Maassen's experiments, quoted later (p. 109), is of great interest in regard to this point.

One good example of retarded development of the disease, out of several which have come to our knowledge, may be cited in the correspondent's own words: "This disease started in an old hive purchased from another bee-keeper, who had lost his bees probably from disease. It was obtained early last spring, but the disease has only made its appearance early this month" (January, 1912). This one stock out of eighteen was first attacked, and within three weeks fourteen others showed symptoms, and all perished within a week of showing symptoms. They were all strong established stocks with abundance of stores, and no bees had been recently introduced into the apiary, nor was the disease present in the neighbourhood.

---

* Some interesting observations on this subject are recorded by *Loveday* (14, vi, 1906) and *Queen Bee* (19, vii, 1906).

In considering such cases, we must always bear in mind the fact that swarms from apparently healthy stocks sometimes develop the disease when placed in new hives.

D.—Infection by means of "Parasite-carriers."

Recent investigations have shown that "parasite-carriers," or individuals which harbour disease-producing organisms, either with slight injury to health or often none at all, are common in connection with many diseases, and are important agents in spreading those diseases. These parasite-carriers may be divided into two classes: those which have come into contact with diseased individuals and have in some other way acquired the organisms without contracting the disease, and those which have suffered from the disease, often in a slight and modified form, and have continued to harbour the organisms for long periods subsequently. The study of bacterial diseases has revealed carriers of both types in connection with diphtheria, typhoid fever, paratyphoid fever, bacterial dysentery, cholera, Mediterranean fever, and many other diseases. Protozoal diseases, such as malaria, trypanosomiasis, piroplasmosis, cocciodosis, and pébrine (p. 52), also furnish many examples of parasite-carriers, especially of the second type. Carriers of both types generally exhibit a high degree of immunity to the disease.

In the *Nosema* disease amongst bees, carriers undoubtedly play a most important part in the spread of infection. Up to the present we have met with one undoubted example of carriers of the first type amongst the bees in an apiary in Scotland. This apiary has been free from any disease since it was started some years ago. We therefore decided to obtain several stocks from it for infection experiments. Before commencing the experiments, bees from each of the stocks were examined, and in each stock a small proportion was found to be infected with *Nosema* spores in small numbers, though no case of grave infection was found. The experiments subsequently made (p. 91) appeared to indicate that these stocks were immune to nosema infection. The remaining stocks in the apiary have remained free from disease up to the present time. We propose to carry out further experiments during this year to ascertain whether the symptoms can be induced in stocks from this apiary, and whether the disease can be produced by feeding with strains of *Nosema* other than the one which they are harbouring.

The observations of *Maassen* (1910) showed that in Germany.

parasite-carriers are extremely common, and he further demonstrated by experiments that the disease could be induced in the stocks in which they occurred by suitable treatment. He states that *Nosema apis* is present in most stocks, and that in Germany there are only a few apiaries that are entirely free. At the same time, the stocks in different apiaries show very decided variations in the degree to which they are infected. In most apiaries the number of parasite carriers among the bees is very slight, though a few can usually be found containing an enormous number of spores.

In a later paper *Maassen* (1911) says that a thorough examination and prolonged observation are often necessary to find the parasite-carriers in apparently healthy stocks.

Maassen and *Nithack* (1910) carried out a most interesting series of experiments. They kept small nuclei, usually two or three frames, without queens, confined in wire cages at a temperature of 14—16° C. under conditions which made infection by food, comb, or box impossible. Under those conditions they found that bees from various sources showed symptoms of dysentery after about four to five weeks, and in all cases *Nosema* was found. One remarkable experiment may be described in detail. Bees were obtained from a well-managed apiary near Berlin, in which no case of dysentery had occurred. The bees were taken from three strong, healthy stocks, and were kept on thin food, two lots on heather honey and one on syrup. On arrival, they appeared to be perfectly healthy. After fourteen days' confinement, spots of excrement were noticed in the cage containing one of the stocks fed on heather honey. *Nosema* spores were not present in the excrement, nor could the parasites be found in the intestines of bees taken from this nucleus. After four weeks, the parasites appeared in the intestine, and were found in the excrement also. The other two nuclei were apparently healthy after four weeks. It was not till six weeks had passed that *Nosema* was found in isolated bees. After a still longer period—about two months—both nuclei still showed no distinct symptoms of dysentery, though the parasite could be found in almost all the bees examined. The parasites were always found in the chyle stomach, where large numbers of the vegetative forms called "Meronten" by Stempell, and immature spores occurred. One of these nuclei appeared to be fairly healthy at the beginning of the third month. It was only at the end of the third month that typical symptoms were manifested.

In other examples given, the incubation period was much shorter, symptoms of dysentery appearing in from fourteen to twenty-one days. They say that at the end of their experiments they had satisfied themselves that a large proportion of the stocks are infected, without showing visible symptoms. They never found a case of dysentery without *Nosema*.

Zander found that if bees containing very few spores were kept at 37° C. on liberal food, all the symptoms of the disease appeared within eight to fourteen days.

These observations and experiments show that parasite-carriers are extremely important factors in the spread of the disease, and that under artificial conditions stocks which harbour them may be caused to develop the disease in an acute form. Under natural conditions probably many factors combine to produce the same results, cold and wet weather, acting by lowering the resistance of the stock, and at the same time affording the carriers greater opportunities of infecting the healthy members, unsuitable food, leading to irritation and lowered resistance of the intestinal cells, confinement to the hive, &c. Possibly the passage of the parasite through successive bees may increase its virulence, as occurs with many pathogenic organisms. Up to the present no attention seems to have been paid to this part of the problem, which is probably one of great importance. It is not improbable that strains of various degrees of virulence exist, and that whereas infection with a strain of less virulence would be of little importance, infection with a virulent strain would lead to the rapid death of the stock.

Whether the individual bee which ingests spores suffers from an acute or chronic form of the disease, or becomes a parasite-carrier without impairment of health, or even escapes infection altogether, also probably depends on a number of factors of which at present we have little knowledge. Climatic and food conditions no doubt play a part, but besides these we have the influence of dose—so well brought out in the case of *B. tuberculosis* by *Cobbett* (1907, p. 1028), and by recent observations on malaria infection—the virulence of the parasite, the natural resistance of the bee, and the influence of the bacteria or their products present in the intestinal canal.

It is apparent from Maassen's observations that a small proportion of the bees in a stock may become infected, and become parasite-carriers, while the majority escape infection. Under these circumstances the stock remains healthy until some combination of circumstances leads to a general infection. On the other hand, his observations also show that after stocks have apparently recovered, parasite-carriers are common amongst them. In the autumn of 1909 he had thirty stocks badly affected with the parasite under observation. Twenty-four stocks wintered well, eight had suffered heavy losses, and one was dead. In May, the disease suddenly reappeared in several of these stocks. The bees showed the typical crawling symptoms, and the spores of *Nosema* were present in enormous numbers. Most of these stocks recovered after a few days. During the summer they remained apparently healthy, but "parasite-carriers" were constantly present, generally in considerable numbers.

The very slow development of the symptoms, even in confinement at a low temperature, under conditions which precluded the possibility of secondary infection, instanced in one of the experiments quoted, leads us to think that some of the cases brought forward by certain observers of symptoms appearing in swarms some months after they had occupied an old hive may have been due to infection from the hive. Occasionally the action of parasite-carriers may be manifested in a way not hitherto mentioned. If healthy stocks are introduced into an apiary of parasite-carriers, they are likely to develop the disease while the original stocks remain healthy. An example of this is quoted on p. 128.

E.—Infection by Human Agency.

While the bees themselves are responsible for the spread of the disease within restricted areas after its introduction, we are of opinion that the reports to which we have had access clearly show that human agency is responsible in many instances for the perpetuation of the disease in some infected apiaries, and for its introduction into many parts of the country.

Carelessness in leaving hives without thorough disinfection in which stocks have died, and placing swarms in such hives, allowing bees to rob diseased stocks or old hives and combs, and other similar acts, have undoubtedly aided in perpetuating the disease in infected apiaries, but have probably had little influence on the general spread of the disease. More important is the practice of replenishing dying apiaries with healthy stocks from other places. The latter sometimes show symptoms within a few days or weeks, or sometimes flourish for a time, especially during the summer. Usually all die. By such means the disease is prevented from dying out. It would probably be better to build up the apiary from stocks which had recovered, or to import bees from infected districts in the hope of obtaining stocks at least partially immune to the disease.

Driven Bees.—The practice of obtaining driven bees in infected areas, and sending them to non-infected districts, and the transference of apparently healthy stocks from infected to non-infected districts, have probably been to a large extent responsible for the present wide distribution of the disease. Queens from driven bees are sometimes introduced into other stocks by means of the cages in which they have travelled. In such cases there is danger from the queen, from the workers which accompany her, and possibly from candy made from infected honey, which has to be eaten away before the queen can be liberated.

Numerous communications show that the writers believe that outbreaks have followed the importation of such bees into districts originally free from the disease. Sometimes the imported stock shows symptoms within a short space of time; sometimes a longer incubation period occurs; sometimes the stock gradually dwindles, and sometimes it dies off during the winter without evident cause, leaving abundance of stores—all manifestations of *Nosema* infection. Occasionally other neighbouring stocks show the symptoms first, presumably because they become infected, and are less resistant to the disease than the infected stock. More rarely the imported stock shows few, if any, symptoms, but its neighbours die off.

In one communication the statement was made that more than one hundred lots of driven bees, all of which were affected to some extent, were obtained in a highly infected district, and exported to other districts.

The exportation of driven bees from the southern counties to the north and other parts of the country has been extensively practised during recent years. Within the last few years most of the southern districts in which the driven bees are obtained have become highly infected, and many of the districts into which they have been imported have suffered severely. We have seen many accounts from Scotland and other parts ascribing the introduction of the disease into apiaries to the importation of certain lots of driven bees or of stocks. Many of these examples are open to criticism owing to the fact that the disease had been previously imported into the district, and the infection might have been obtained from local sources. Several examples free from these objections have, however, come to our notice, from three of which we give quotations:—

"Our apiary was the only one affected in this district, the disease originating in an English swarm of last season (1910). I imported six swarms from a Devonshire beekeeper that summer, and in the following spring one went under with the disease. . . . I have no doubt at all in the matter, as the disease is unknown here among our native bees."

"During the last twenty-five years I have taken a pretty keen interest in the industry, but until recently I have never had trouble with disease of any sort. In June, 1910, I had several swarms from Hampshire, two of which a fortnight after I received them showed signs of disease. . . . By the end of October both hives died out." (The bees exhibited the typical crawling symptoms, and specimens which we examined were heavily infected with spores.) 'By the end of the year three other colonies showed strong symptoms of the disease and are now dead."

"The first contaminated stocks in the county were brought or sent last autumn, imported from a diseased area (driven bees). Nine lots were sent and were distributed over different parts, and all these have been traced, and they have all succumbed to the Isle of Wight disease. In some cases all the bees where the imported bees were put have died, and in one case the imported lot died, and one other in the same spot survived; in this case there was no robbing. Where the imported bees died and robbing went on all the bees were affected."

The importation of queens from infected regions has possibly been the means of introducing the disease in certain cases. The methods by which an infected queen is liable to communicate the disease to the stock have already been discussed (p. 103).

F.—The Spread of the Disease within Small Districts.

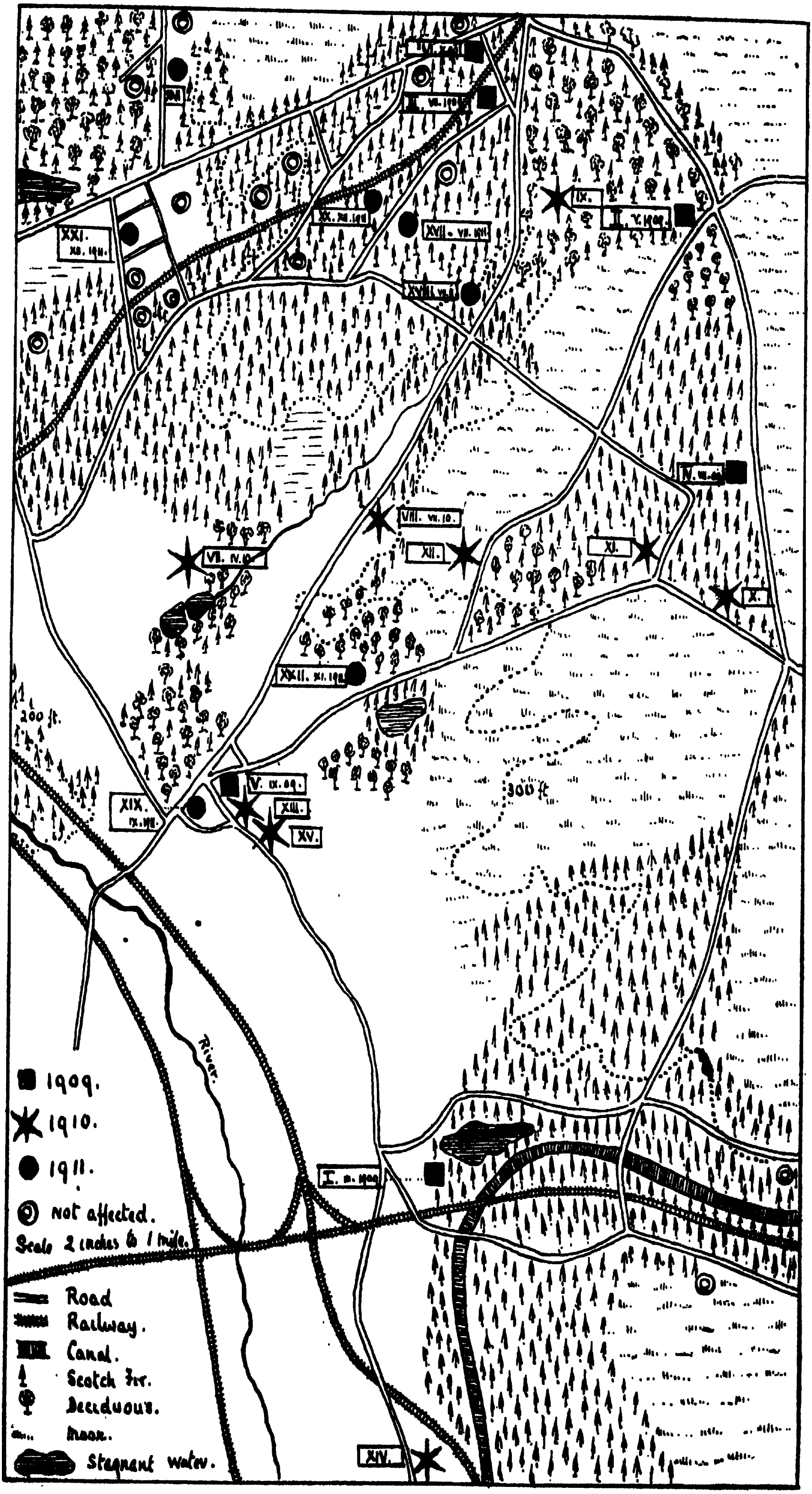
The spread of the disease within large areas and countries has already been considered (Section I.), and it has been shown that extraordinary irregularities occur in the distribution of the disease, small, non-infected islands being occasionally found in the centre of highly infected districts. After longer or shorter intervals of time these islands usually become affected.

Several instances of extremely uneven distribution and spread within very limited areas have been brought to our notice. The facts relating to a good example have been most carefully recorded by Miss A. D. Betts, who has kindly supplied us with her notes, from which we quote, and with charts, from which the sketch-map reproduced on the following page has been constructed.

Although all the bees in the apiary marked No. I. died in March, 1909, apparently from the Isle of Wight disease, there is no evidence that any of the other apiaries were infected from it.

The next apiary to be infected was No. II. in May, 1909. The disease was probably imported by foraging bees from the district lying east of this point, where there were cases in the spring. A stock of black bees swarmed on May 10th, 1909; the swarm was hived, and all went well for eight to ten days. Then the bees of the swarm started crawling in hundreds. The parent stock deserted its hive and flew away, although stores were present in the hive. The disease continued till the winter of 1910–11, when the last stocks died out.

Apiary No. III.—A swarm of unknown origin was hived in July, 1909; it died out under suspicious circumstances in the winter of 1909–10. The hive was left as it was, and another strange swarm hived in it in July, 1910. This and another stock, which


VI. x. 09
XVI
II. VII. 1909
XXI. XII. 1911
XX. XII. 1911
XVII. VII. 1911
XVIII. VII. 11
IX.
II. V. 1909
IV. VII. 09
VIII. VII. 10.
XII.
XI.
X.
VII. IV. 10
XXII. XI. 1911
200 ft.
300 ft.
V. IX. 09
XIII.
XV.
XIX. IX. 1911
River.
I. III. 1909
XIV.
■ 1909.
✶ 1910.
● 1911.
◎ not affected.
Scale 2 inches to 1 mile.
Road
Railway.
Canal.
Scotch Fir.
Deciduous.
Moor.
Stagnant water.

had been in the apiary for some years, developed symptoms in the spring of 1911. All the bees are now dead.

Apiary No. IV.—The first stock affected here stood at the end of a row of five, and developed the disease in July, 1909. The other four developed it, and died out in the autumn of 1909. In July, 1910, the disease attacked a row of eleven stocks in another part of the garden, all more or less at the same time. In the beginning of 1911 only three stocks were left, which were increased to eight during the summer. At the present time at least five have the disease.

Apiary No. V.—In this apiary the symptoms were first noticed in September, 1909. All the bees were dead in March, 1910.

Apiary No. VI.—The bees first became weak, and exhibited crawling symptoms. They were found dead in their hives in October, 1909.

Apiary No. VII.—One stock, which had been obtained from Apiary No. IV, developed the disease in April, 1910. Two other stocks have since shown symptoms.

Apiary No. VIII.—The bees in this apiary first showed symptoms in July, 1910, and all died during the winter.

Apiaries Nos. IX, X, XI, XII, XIII, and XIV.—All the bees in these apiaries died during the winter 1910–11.

Apiary No. XV.—Two stocks died in March and May, 1911. They first showed symptoms in the spring of 1910. All the bees in this apiary are now dead.

Apiary No. XVI.—In this apiary the disease began in November, 1911. At present there are five stocks—four diseased and one healthy.

Apiary No. XVII.—This apiary consists of two stocks. The symptoms were first noticed in July, 1911, in a swarm from one of these. The old stocks developed the disease in October, 1911, but are still alive.

Apiary No. XVIII.—Two stocks. One developed symptoms in July, and the other in December, 1911. Both are still alive.

Apiary No. XIX.—In this apiary there are four stocks, all diseased. The symptoms first appeared in September, 1911.

Apiary No. XX.—This apiary consisted of three stocks. Symptoms first appeared in October, 1911. All are now dead.

Apiary No. XXI.—One stock here is diseased. The symptoms first appeared in December, 1911.

Apiary No. XXII.—The bees in this apiary appeared to be healthy in June, 1911, but are now dying fast.

In the accompanying map the apiaries which developed the disease in 1909 are represented by black squares; those which developed the disease or died out in 1910, by stars; and those which developed the disease in 1911, by black circles. The number of each affected apiary and the date of commencement of symptoms are given beside each mark, except, in Nos. IX–XIII, which died out in the winter of 1910–11. The apiaries which are at present healthy are marked by concentric circles. The wooded areas and moorland are indicated, as well as the pools of stagnant water. The unshaded areas consist of pasture land, some of which is marshy.

It will be seen that in 1909 the disease was almost confined to the eastern border of the district. In 1910 almost all the central apiaries were attacked, while in 1911 some of the northern apiaries were affected. It will be noticed that most of the central apiaries are situated in the clear area between the wooded regions. Possibly the intervening woods protected the northern apiaries, a considerable number of which are still unaffected.

Of the twenty-two apiaries attacked in this area no less than fourteen have been completely destroyed.

There is no evidence that infected water supplies played an important part in the dissemination of the disease in this district.

The map well illustrates the slow spread of the disease in a district in which infection was apparently carried mainly by the agency of living bees.

G.—*The Influence of Climatic Conditions.*

Although the older writers differ as to whether mild or severe winters produce the greater mortality among bees, bee-keepers have always agreed that wet and cold summers are unfavourable.

We have already pointed out that wet weather aids in the dissemination of the parasite from hive to hive owing to the bees taking up moisture near the hives from foliage and gravel paths grossly contaminated with infected excrement. Indirectly, wet and cold weather probably influences the progress of the disease by affecting the quantity and quality of the food, by lowering the resistance of the bee, and by affecting the conditions of bacterial life within the bee.

Many correspondents have been inclined to attribute their losses to the weather conditions of the last few years, and so far as we know, all epidemics of the disease in this country have been correlated to wet seasons. The important epidemics of 1782–83 and 1860–63 were associated with wet summers, and the outbreak of paralysis of 1881 occurred during "the long run of wet years which terminated in 1883" (*Mill*, p. 194).

We have looked up the records of the local observers as to the weather conditions in some of the districts in which the disease was prevalent in 1910, and quote examples from England, Scotland, and Wales respectively:—

"With two exceptions the wettest year in the twenty years' record and with more rainy days than in any other year" (*Mill*, p. 32). "With the exception of 1906 the rain was the greatest in the past forty-three years" (p. 48). "An unusually wet year, the excess being especially notable in the summer months" (p. 45).

It should be pointed out in considering weather reports that a month without excessive rainfall may nevertheless have an unusually large proportion of damp and cold days.

The effect of the fine summer of 1911 was very noticeable, for many badly infected stocks apparently recovered, and during the dry weather the disease was little in evidence. The apparent prevalence of the disease greatly increased when the wet weather set in.

We think that the state of the weather has a great influence on the disease, but further work and observation are necessary before the connection is completely understood.

Summary.

In this section we have discussed in detail the various ways in which the infection may be brought into the hive, disseminated amongst the individual bees in the hive, and spread from hive to hive and apiary to apiary. We have shown that the infection may be transmitted through the agency of infected foods or of living infected bees. Infected water, especially rain-water grossly contaminated with excrement in the vicinity of hives, and honey, present in hives in which bees have died, seem to be the most important infected foods. Foraging bees infected by ingesting these foods, and "parasite-carriers," whether queens, drones, or workers, are the most important agents of infection. The latter may be present in stocks which have never suffered from the disease, or in dwindling stocks showing few symptoms, or in stocks which have suffered from the disease and apparently recovered.

The introduction of the parasite into the hive is not necessarily followed by the appearance of the symptoms of the disease. It is probable that the stock sometimes remains healthy, and the infected bees are gradually eliminated; sometimes weeks or months elapse before the symptoms appear; occasionally the stock suffers severely for a time and then apparently recovers, though usually it succumbs in the end. Frequently the stock suffers from a mild form of the disease, but gradually becomes weaker and dies, and more rarely acute symptoms develop within a few days. Some stocks show no symptoms, but the "parasite-carriers" are not eliminated, and partial immunity is produced. We wish to emphasise the fact that in the production of this disease, as in the production of most others, various factors are concerned besides the mere introduction of the infecting agent. The initial dose probably plays a most important part. If any large numbers of *Nosema* spores are introduced from some highly contaminated source, an acute outbreak of the disease is to be expected, such as occurs in infection experiments on a small scale. If few spores are introduced, the results will vary, depending on the influence of various factors, such as the natural resistance of the bees, the virulence of the organism, the condition of the weather, the quality of the food, &c. Many bees exhibit considerable powers of resistance to this parasite, as evidenced by the fact that they are capable of surviving while the parasites develop in immense numbers in the cells of the chyle stomach and reach the spore stage. Zander thinks that every infected bee dies sooner or later as a result of the infection, but our observations indicate that the parasites sometimes occur in small numbers, and reach the spore stage without apparently affecting the health of the bee.

Our experiments show that old spores from dead bees seem to be less virulent than fresh spores from bees which have recently died of the disease. It is very probable that under natural conditions different strains of the parasite possess different degrees of virulence, some being almost completely non-virulent. The virulence of less harmful strains is probably increased by passage through successive bees.

Unsuitable food, especially for wintering, lessens the natural resistance of the bee, and enables the parasite to develop more readily. Cold and damp weather and other unfavourable conditions act in the same way. On the other hand, suitable food and favourable climatic conditions increase the natural resistance of the bees, and, at least for a time, keep the symptoms of the disease in check.

By reference to Section VIII. it will be seen that occasionally spores may be found in dust, and may sometimes be carried by ants, &c.; but in the present state of our knowledge we do not know how much importance need be attached to these possible modes of infection.

SECTION VIII.

SOME FIELD OBSERVATIONS ON NATURAL METHODS OF INFECTION.

By H. B. FANTHAM, D.Sc., B.A., and ANNIE PORTER, D.Sc.

After experimentally proving in 1906 that *Nosema apis* could, and did, kill bees, we have spent some time each year since in tracing various natural methods by which bees acquired the spores of *Nosema apis*, and, from the information gained in the open, devised some of the laboratory experiments detailed in Section VI, A. The results of our observations on natural methods of infection may be summarised here.

The most obvious source of spores consists of the contaminated food stores in the hive. As already stated, we have made examinations of combs from infected hives, and have found combs covered with excrement containing spores of *Nosema apis*. The honey, sealed and unsealed, in the combs also was contaminated with spores, while pollen stored for reserve food was also a reservoir of disease. In some cases we have reason to believe that the stored pollen was contaminated with excreta. Further, extracted honey bought in the market has been subjected to microscopical examination, with the result that several infected samples were found. Thus, it is possible to spread the disease to healthy stocks by supplying them with winter stores from a contaminated source. The use of old comb also is a danger.

Again, young bees may emerge as perfect insects, but infected with the disease by the food with which they have been supplied. We have found unsealed very young grubs, larvæ, and young sealed bees with the young stages and the spores of the parasite lodged in the intestinal walls, showing that they had been infected, since the nosema had multiplied within their bodies.

In 1909–10 we had the opportunity of watching a hive, all of whose bees had died. It had been left empty, and the owner refused for some months to allow it to be opened. In the neighbourhood there were other hives, and we watched bees visiting the empty hive and going away from it. Some of these robber bees were caught and examined. Their honey stomachs were full of honey obtained from the hive, and in this honey on several occasions *Nosema* spores were found. Further, robber bees captured and kept in captivity showed young stages of *N. apis* in the walls of their chyle stomachs after three to five days, and in the majority of cases died from the effects of these young forms. Later we heard that several hives in the village had become extinct, and it is probable that this was the result of robbing the hive that we had observed, for it was agreed in the village that the said hive was the first case in which disease had appeared.

Bees in captivity and in hives have been observed by us cleaning themselves and one another of excrement. Examination of the said excrement has shown spores of *N. apis* on several occasions, and the spores are thus passed on to new hosts.

The roving habits of drones are well known. One instance among several may be quoted. We marked two drones, and set them at liberty. Seven hives were in the neighbourhood. The drones both entered the first hive. The visit was short, and they emerged with other bees after twenty minutes. After a brief halt outside hive I, they entered hive III. Two hours later one emerged, the other still remained. Some distance away was hive VII, which the drone entered. It had not emerged at sunset, nor had the other drone come out of hive III. Watch was kept next morning, and both drones emerged from the respective hives, one having spent twenty hours in hive VII, and the other twenty-two hours in hive III.

An observation of some interest has been made by us on several occasions. When the bees seemed very thirsty, we have seen them suck up freshly voided fæces from obviously sickly neighbours. This was done although an abundance of liquid honey was present in the box in which the bees were confined. Dissection of some of these bees has shown that the fore-gut contained spores that were obviously freshly absorbed, together with small quantities of partially digested pollen acquired as fæces from infected neighbours.

In one locality we observed a bees' drinking place. This was a set of stones around a water-tap set in the midst of a mass of gooseberry and currant bushes. Ordinarily there was little evidence of the bees' visits left on the stones, but when disease appeared in the neighbourhood—the result of importing some fresh stock—the sides of the tap and the stones soon showed yellowish splashes of excrement, and the tiny pools in the hollows of the stones at which the bees drank contained bee fæces also. Some of the excrement and the water were collected and examined. Both contained spores of *Nosema apis,* and so were a source of infection to any bees drinking at this spot.

In the same neighbourhood we have examined dew from low-growing plants from time to time. This dew has been found to contain *Nosema* spores on five occasions. Numerous examinations, however, were not made.

Many examinations have been made of dust and rain-water from the leaves of plants growing near infected hives. On one occasion a bee-keeper told us that the bees always died in larger numbers than usual after visiting certain lilac bushes near the hives. He based his observation on the larger number found crawling near the hives a few days after they had been noticed among the lilacs. We examined the bushes, collected excrement, dust, a little water from among some clusters of leaves, and obtained a liquid by washing some of the flowers. In each case the microscopical examination showed the presence of *Nosema* spores which could be a source of disease. Some spores were recovered from practically every species of plant in both the flower and vegetable garden in this particular case.

Another interesting series of observations was made on the influence of the wind as a distributing agent for *Nosema* spores. One case that we observed may be cited. It occurred in a district where one hive only was infected. As it was a new stock, the owner was loath to destroy the hive. The next nearest hive was some four hundred yards away, and a field with a very low hedge of sloe and hawthorn, with one stunted crab-apple, intervened. There was a drop in level of about 8 ft. between the two hives, the infected one being at the higher level. The soil was somewhat chalky, and a heavy south-west wind often deposited a fine, perceptible dust on the lower hive. On several visits dust was collected from the hedge and the plants in all parts of the field, and was examined microscopically. A few *Nosema* spores occurred in some samples. The owner of the second hive was warned to look out for crawling bees unable to fly. This was done, and later we received six sickly bees picked from the ground outside the second, lower hive. Four of these bees had young stages of *Nosema apis,* one had spores, and one seemed uninfected. From that day onwards crawling bees were found daily, and were destroyed by the owner as soon as taken. After a short time the infected stock was burned. Meanwhile we examined the plants in the neighbourhood between and around the two hives, and found that for a considerable distance *Nosema* spores were mingled with the dust on the plants. When this dust is washed down by rain, &c., the water may be a source of infection to the bees that drink it. While it is possible that the wind may have had a share in distributing *Nosema* spores in the area we examined, we cannot be certain that the second hive became infected thereby, since we were not able to exclude the possibilities of infection at drinking places, visits of infected drones, &c. It may also be noted that the blossoms of the crab-apple were visited by bees from the original sickly hive, and that the blossoms were frequently polluted by their infected fæces. Healthy bees could then foul themselves with excrement containing *Nosema* spores when visiting the blossoms.

We do not infer from the cases we have observed that the wind-borne spores alone are the causes of outbreaks of disease, but merely point out that there is a suspicion of such being the case in a few instances which have come under our observation.

We have also examined certain other insects that visit hives to ascertain if they acted as carriers of *Nosema,* and also if they themselves became infected. The results of the examination of the organs of such insects are given in Section IX. The only insects examined in large numbers were the black and tawny ants. A frame from a hive in which all the bees had died, a few long-dead bees, and a number of living ants from the hive were sent to us. The bees contained a few spores of *Nosema.* The honey and pollen in the frame were also infected. Rapid examination was made of the ants, with the somewhat surprising result that some 60 per cent. of them were found to contain free spores of *Nosema.* Excrement from the ants also contained the spores.

Since then, examination of ants from several other sources where disease among bees has occurred has been made, and the result has been to show the presence of *Nosema* spores in the gut of a few of the ants in almost every case.

As ants will visit any hive available for the purpose of getting honey, and as they contain spores of *Nosema*—which so far does not seem to harm them—and void the spores intact with their excrement, they must be added to the list of means whereby infection may be spread from hive to hive.

Finally, some bees have been found which, although infected by *Nosema* which has reached the spore stage, do not seem to be injured much thereby. Nevertheless, these bees void excrement rich in *Nosema* spores, which excrement can be taken up by other bees in various ways. They thus serve as reservoirs of disease, and undoubtedly are a source of danger both to the colony to which they belong and to bees from other hives. Such infection can be acquired by bees from contact with diseased bees, from cleaning themselves or the other bees, and by ingesting nectar, pollen, or water fouled by these parasite carriers.

SECTION IX.

EXAMINATIONS OF CERTAIN INSECTS FOUND IN HIVES.

By H. B. FANTHAM, D.Sc., B.A., F.Z.S., and
ANNIE PORTER, D.Sc., F.L.S.

(1) *Wax Moths.*—We have been able to examine only a few specimens of wax moths.* From those specimens of the greater wax moth, *Galleria melonella,* which we examined, we concluded that *Nosema apis* was not present as a parasite in the body of the wax moth. No young stages or other forms were found in the intestinal wall. But on five occasions small quantities of spores were found in the alimentary tracts of moths as well as in their fæces, so we may conclude that they are occasional agents in the dispersal of *Nosema* spores and so in the spread of disease. Wax moths are well known to visit hives successively, and so can act as carriers of disease.

(2) *Ants* are well known as robbers of honey. We examined numbers of both black and tawny ants from neighbourhoods where *N. apis* had occurred. The ants never appeared to contain young forms of the parasites, though a few spores were usually present (in 60 per cent.). It appears probable that the spores are ingested with stolen honey and pass unchanged through the alimentary canals of the insects, are voided elsewhere, and so occasionally cause new infection. As with wax moths, ants are visitors to more than one hive, and rob any hive indifferently.

(3) *Ichneumons* were very rarely found in association with bees we examined. As we had such scanty material, the examination of which gave negative results, we prefer to make no statement at present regarding the possible *rôle* of ichneumons in the transmission of *Nosema apis.*

(4) *Small Mites* (*Braula cœca*) were present on some of the bees sent to us for examination. These little pests cause irritation to the bees, and locally the dwindling of some swarms was referred to as "sweating due to lousy bees." Though we examined a

---

* In recent years, owing to the greater precautions taken by some bee-keepers, fewer waxmoths appear to reach maturity, at any rate in some places.

large number of these mites, we found no *Nosema apis* spores in them, nor were young stages of the parasite present.

From these examinations we conclude that, at any rate in some cases, wax moths and ants can take a share in spreading *Nosema apis,* that they act purely mechanically, the spores of the parasite acquired with food passing unchanged through their bodies and being voided elsewhere.

SECTION X.

TREATMENT AND PREVENTION.

By G. S. GRAHAM-SMITH, M.D., and G. W. BULLAMORE.

A. *Treatment.*

Up to the present, drug treatment of the affected stocks appears to have been of little value. Most of the records to which we have had access show that drug treatment in the great majority of cases has not produced any effect on the symptoms or rate of mortality. A few observers have stated that treatment by means of drugs has diminished the symptoms for a time. When we consider the extraordinary fluctuations in symptoms which some hives exhibit, it is scarcely surprising that drugs occasionally seem to be beneficial. So far as we know, no undoubted example of a permanent cure has been recorded. Considering the nature of the causative agent, we think it exceedingly improbable that any of the usual drugs will be found to be of value. Some protozoal diseases can be cured by the administration of large doses of arsenic compounds, but such compounds are obviously unsuitable in the feeding of bees, since it is probable that considerable quantities would be found in the honey. In most of such diseases hitherto investigated it has been found necessary to administer the drug in doses which are immediately fatal to the parasite. In the case of bees this would probably be an insuperable difficulty. Smaller doses are unsuitable, for it is found that they result in some cases in the evolution of a drug-proof parasite.

Apart from drug treatment, some evidence has been produced by Maassen (1911) and others that the substitution of candy and syrup for natural stores for wintering is sometimes beneficial. In regard to paralysis in Australia, *Beuhne* (15, viii, 1908) has the following interesting remark: "I have on several occasions eliminated the disease *for the time being* by feeding thin honey continuously for several months. It is a well-known fact that many honeys from various sources are unsuitable for wintering. Such honeys, by setting up digestive troubles, and perhaps by allowing of the undue multiplication of the intestinal bacteria, lower the resistance of the bees and aid the parasites in obtaining a foothold.

B. *Prevention.*

(1) *Water Supplies.*—If, as we think, infected water supplies play an important part in the spread of the disease, care should be taken to provide the bees with an easily accessible supply of fresh water, which should be changed daily. As far as possible they should be prevented from obtaining water from stagnant sources, which can become contaminated, and if necessary the usual drinking places should be removed. Unfortunately, it may often be impossible to restrict the bees to any one source of supply. When this is the case, it would be possible during the spring to lessen the demand for water by placing ordinary feeders containing thin syrup over the clusters in each hive.

(2) *Dead Bees.*—Zander reminds his readers that the duration of life and of infectivity of *Nosema* spores is unknown, but that it has been ascertained that in damp surroundings, even in the bodies of dead bees, they can live a long time. He has shown that they are capable of causing infection after being kept for a year. Our own experiments demonstrate that they are capable of causing infection after remaining in the bodies of bees for several months. Zander, therefore, recommends that all bees dying with suspicious symptoms should be carefully collected and burnt, and that the ground round the hives should be dug up and turned over. Wherever possible, treatment of the ground with some strong and suitable disinfectant ought to be undertaken as an additional safeguard.

(3) *Disinfection of Old Hives.*—It has repeatedly been shown that an old hive, in which a stock has died of the disease, is a source of danger to any fresh stock placed in it. All the contents, combs, quilts, &c., of such a hive which can be easily removed should be burnt, and on no account should they be left in such a place that bees can get at them. The most efficacious method of disinfecting the interior of the hive is by slightly charring it with a painter's lamp. The outside should be similarly treated and subsequently painted. If charring is thought to be objectionable, bleaching powder, formalin, or carbolic acid may be used, though very thorough application is desirable. Whenever practicable, the ground round should be disinfected in some way.

(4) *Destruction of Diseased Stocks.*—Zander thinks that a bee suffering from infection with *Nosema apis* never recovers. We are unable to say whether this statement is absolutely true or not. Our infection experiments, however, show that bees infected with old spores may live for some weeks. Infection with fresh virulent spores usually results in death within a few days. The fate of the individual infected bee and of the stock, as we have already

pointed out (p. 117), depends on many factors. From the point of view of prevention, the most important question to be decided is whether a diseased stock ought to be destroyed or not. All the evidence we have obtained points to the conclusion that a stock exhibiting a heavy and continuous mortality never completely recovers. The mortality may decrease, but the stock eventually dies, often during the winter. Since such a stock is a continual and serious source of danger, it ought to be destroyed. Some stocks show a great mortality for a short time, and then apparently recover. In such a case infection may be of short duration from some highly contaminated source. The foragers may ingest the spores in large numbers and be killed off by the young developing stages of the parasites, causing little or no infection of the other bees in the hive. Such a condition, if it occurs, must be rare. Usually parasite carriers remain, and the disease again makes its appearance when a favourable opportunity arises. In all such cases the destruction of the stock is probably the safest policy. An attempt may perhaps be made to preserve stocks which only show mild symptoms, or slight dysentery, or spring dwindling. If the apiary is a large one, a great risk is however incurred of infecting other stocks, entailing in the end severe losses. In our opinion, owners of apiaries, especially in non-infected areas, could save themselves much loss and trouble if they at once destroyed the stocks which first exhibited unmistakable symptoms of the disease. Without the proof afforded by many examples, we feel we cannot insist very strongly on this measure, since it might often happen that several hives were infected before the appearance of definite symptoms. Further, it should be pointed out that destruction of the stock does not make the surroundings it has contaminated free from the parasite. We should therefore advise the removal of the healthy hives to another site, if such a course is possible. In several instances which have been brought to our notice, this procedure has been followed with marked success.

(5) *The Preservation of Apiaries.*—In many apiaries situated in infected areas it has been the practice to replace the stocks which died by others. These stocks in turn become infected after a longer or shorter time, and thus the disease is kept alive. When the disease visits an apiary bees should not be imported into it, at any rate not from a non-infected district, until the disease has run its course. If it is considered desirable to introduce fresh stocks they should be obtained from an infected area, since, if they have survived an attack, they may be to some extent immune. Even partially immune bees cannot be expected to survive, if they receive large doses of infected material, though they may

be able to resist small doses. If all the stocks, or the great majority of them, are badly affected, it would be wise to destroy them after the honey flow, and to disinfect the hives and appliances. A start can then be made in the following season with a reasonable prospect of success, provided that precautions have been taken to remove as far as possible all sources of infection. As an additional safeguard, driven bees might be wintered in the district in which they are obtained. If healthy in the spring, they could then be imported. If symptoms of the disease have appeared, they ought to be destroyed. It must be pointed out, however, that unless all the bee-keepers in a district combine to carry out such measures, successful results cannot be expected, for apiaries in which the disease has been kept up will, in the course of time, cause infection in their neighbours'. The havoc caused by spread from apiary to apiary is well illustrated in the map on p. 114.

In all cases where it is desired to re-stock an apiary, we advise that some months should be allowed to elapse between the death of the last stock and the importation of fresh bees.

(6) *Driven Bees.*--It has been abundantly proved that driven bees, and apparently healthy stocks imported from infected areas, have introduced the disease into districts which had previously been free from it. We have therefore no hesitation in saying that bee-keepers in non-infected districts run grave risks by importing driven bees or stocks from areas in which the disease is prevalent. There is some evidence that imported queens have introduced the disease. Care should therefore be taken in ascertaining the condition of the bees in the place from which the queens are obtained.

(7) *Building up Apiaries.*—Maassen's observations show that partially immune stocks and apiaries are common in Germany, and we have investigated at least one partially immune apiary in this country. The accounts of bee-keepers indicate that some stocks are more resistant than others, for they escape the disease or suffer very slightly, when other stocks around them, apparently similarly situated, succumb. We think that good results might be obtained if attempts were made to build up apiaries from stocks which show well-marked resistance to the disease in infected apiaries, or from stocks known to be partially immune.

From the accounts we have received we are able to state that immunity does not seem to be correlated to colour or race, since yellow, leather-coloured, black and hybrid bees are reported to have escaped the disease in different districts.

In this connection the observations of *Beuhne* (15, viii, 1908, p. 998) are of great interest. He claims that leather-coloured Italians possess considerable immunity to paralysis, and that this can be enhanced by careful breeding. "Fifty colonies which were sent to me from an apiary quite free from paralysis developed this disease in a most virulent form within a few days after being placed in my apiary, my own colonies showing no signs of paralysis, even when the new arrivals had become almost extinct."

In this case no doubt Beuhne's colonies were parasite-carriers, and infected the new stocks.

The main methods of infection have been fully discussed in Sections VII. and VIII. We feel that it would be superfluous on our part to give advice to practical bee-keepers who have studied these sections, in regard to such matters as the prevention of robbing, union of weak stocks, &c. Infection by means of dust, infected ants, wax moths, &c., scarcely require detailed consideration, and can be dealt with as occasion arises.

SECTION XI.

MICROSPORIDIOSIS IN OTHER *HYMENOPTERA*.

It is obviously a matter of considerable importance to decide whether other hymenoptera, such as wild bees, wasps, &c., can be infected with *Nosema apis*, and are capable of transmitting the disease under natural conditions.

Up to the present this subject has been somewhat neglected, but a few infection experiments have been carried out, and a small number of observations on wild bees made. As these observations were made at different places without collaboration, it has been decided to record them separately.

A.—Infection Experiments.

By H. B. FANTHAM, D.Sc., B.A., and ANNIE PORTER, D.Sc.

Mason Bees.—In 1907 we introduced hive bees which had died owing to infection with *Nosema apis* into the tunnels of Mason bees. The latter had built in a piece of old wall which was screened off for the purposes of experiment. Previous to the commencement of the experiment a number of the Mason bees were examined for the presence of *Nosema*, with negative results, and twenty were isolated to act as controls. In about a fortnight the colony of Mason bees had died out. Twenty were examined, and in twelve *Nosema* was found. The controls remained healthy.

A similar experiment was carried out in May, 1911, by some friends, and in this case also the Mason bees died of the disease.

Wasps.—Wasps belonging to a certain nest had been kept under observation because *Herpetomonas vespæ* (a harmless intestinal parasite of wasps and hornets) had been found in them. In May, 1909, some bees which had died of *Nosema apis* were placed in the nest. The nest, a small one, was kept under close observation. After about a fortnight no wasps were observed to leave the nest, and when the latter was dug out, both the adults and brood were dead. *Nosema apis* was found in twenty of the worker wasps, and also in the queen.

We examined a few specimens of both Mason bees and wasps from districts in which bees had died "mysteriously," and in a few cases detected *Nosema* spores. The life-history of *Nosema apis* in Mason bees and wasps is the same as in hive bees.

B.—Observations on Humble Bees.

By H. B. FANTHAM, D.Sc., B.A.

During the summers of 1910–11 about twenty-four specimens of the common humble bee, *Bombus terrestris*, were examined. All were very feeble. In many cases the bees were infected with a parasite that strongly resembled *Nosema apis* in its external appearance, but the trophozoite often appeared to attain the meront condition without separation of the daughter meronts before sporogony occurred. The parasite thus formed large multinucleate masses resembling those found more rarely in *Nosema apis* in hive bees. The organs parasitised were chiefly the chyle stomach and the Malpighian tubules. The small planont form of the parasite was also present in the hæmocœlic fluid. The greater number of spores were found in the Malpighian tubules, which were at times almost blocked with them.

The fat body in fifteen of the bees which were examined also contained some microsporidian spores. Whether these spores are those of *N. apis* remains to be determined.

C.—Infection Experiments and Observations.

By G. S. GRAHAM-SMITH, M.D.

I. *Infection Experiments.*—The writer attempted to infect, by feeding on syrup containing spores, a colony of humble bees and another of wasps kept in captivity. The humble bees lived for four weeks, and the wasps for about three weeks. In both cases a few of the insects showed infection with *Nosema,* but in the majority of those examined the parasite was not found.

A queen wasp was fed on spores daily for three weeks. At the end of this time she appeared to be growing feeble, and was killed. Numerous ingested spores were found in the gut contents, but infection of the gut epithelium had apparently not occurred. Another queen wasp was fed daily for seven weeks on candy containing numerous old *Nosema* spores. Eventually she died, but on examination was found not to be infected..

II. *Observations of Wild Bees.*—The writer examined a few wild bees of various species from various districts, including the Isle of Wight, during the summer of 1911, without finding *Nosema* spores in any of them.

Late in the summer, however, numbers of dead and dying humble bees of various species, *B. terrestris, B. lapidarius,* and

B. hortorum, were noticed under a tree near the Cambridge Laboratory. On examination, many of these were found to be infected with *Nosema apis* (Plate VI). On August 26th, eight dead humble bees were examined. Two were apparently not infected; in two, *Nosema* spores were present in large numbers in the epithelial cells lining the chyle stomach, but none were found in the Malpighian tubes. In two, spores were present in very large numbers, both in the cells lining the chyle stomach, and within the Malpighian tubes; in one large numbers were found in the cells of the chyle stomach, and a few in the Malpighian tubes. In the eighth bee slight infection of the chyle stomach and of the Malpighian tubes was found. On August 28th ten dead humble bees picked up at the same place were examined, but in eight neither spores nor young forms of *Nosema* were found. The other two showed slight infection of the chyle stomach with spores. On August 29th and 30th twenty dead humble bees were examined without finding either spores or young forms of *Nosema*. On September 4th, however, most of the dead humble bees picked up under this tree were heavily infected with *Nosema* spores. The examinations were continued as opportunity occurred throughout September, and waves of intense infection like those just described were again noticed.

The cause of this curious condition was not ascertained. So far as the writer is aware, such waves of infection have not been noticed amongst honey bees. Systematic daily examination of infected stocks have, however, not been carried out, and it is possible that periodic infections may occur, though they have hitherto escaped notice. Their occurrence might help to explain some of the anomalous symptoms which have been recorded.

A few humble bees collected in Hertfordshire on September 29th also showed large numbers of spores in their Malpighian tubes and chyle stomachs.

In conclusion, it must be pointed out that, though Fantham and Porter's experiments indicate that wild bees and wasps may act as parasite-carriers, we cannot conclude without further proof that the *Nosema* found in naturally infected humble bees belongs to the species *Nosema apis*. To prove this point, hive bees should be experimentally infected with spores derived from naturally infected wild bees. Experiments of this nature have not been undertaken yet.

It is interesting to note that in 1862 a correspondent in *The Field* (p. 590) mentions that he had noticed humble bees in hundreds lying dead under chestnut trees.

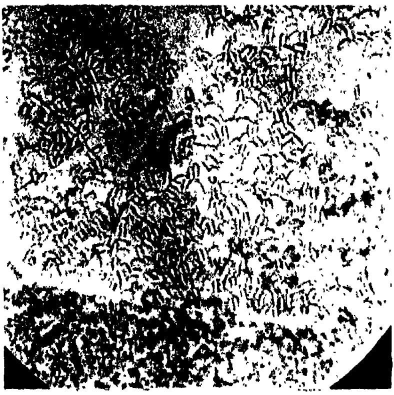


Fig 1

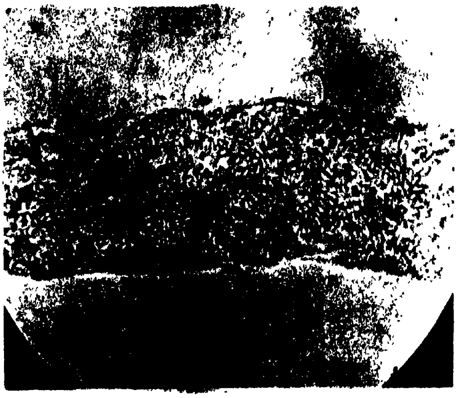


Fig.2.

Fig.3

PLATE VI.

Fig. 1—Photograph showing spores liberated by the rupture of a Malpighian tube of a humble bee. A portion of the infected tube is seen in the photograph. (×500.)

Figs. 2 and 3—Photographs of unruptured Malpighian tubes filled with spores. (×500.)

SECTION XII.

BACTERIOLOGY OF THE DISEASE.

By W. MALDEN, M.D.

Since the presentation of my report (1909), a considerable amount of work has been done, with the object of ascertaining whether or not *B. pestiformis apis* exercises any pathogenic action in this disease. A large number of bees, both from healthy and diseased stocks, have been examined for this organism, and the result of these examinations has been to show that the bacillus in question is present in about 40 per cent. of the infected bees,* either in the chyle stomach or in the small intestine; and that it has not at present been discovered in chyle stomachs of bees from healthy stocks. Infection experiments with this organism have failed to produce the disease in healthy bees, and in the light of our present knowledge of the causative agent, it must be acknowledged that the *B. pestiformis apis* is not the primary infective organism. The possible part played by this organism as a secondary infecting agent is discussed later on.

In a great number of instances, when stained smears from the chyle stomachs of diseased bees were examined, it was noticed that the bacteria present were considerably more numerous than in similar preparations from healthy bees. Attempts were made to count the organisms present in healthy and diseased specimens by means of the following method:—

A bee was killed, the abdomen cut off from the thorax, and the alimentary canal carefully dissected out under water. The chyle stomach was separated from the intestine, and the Malpighian tubes removed. The distal third of the chyle stomach, about 0·25 cm. in length, was cut off, and the contained food material removed by gentle pressure. This portion of the chyle stomach was then placed in a small-footed test-tube containing 0·5 c.c. of distilled water, and ground up as finely as possible with a glass rod. A measured volume of the resulting emulsion was evenly spread over a measured area on a glass slide and allowed to dry, fixed in the flame, and stained for one minute in Bordet's alkaline methylene-blue. The preparation was then washed, dried, and examined microscopically. The number of bacteria present in twenty-five microscopic fields were counted in the upper, middle, and lower portions of the stained specimen.

---

* 202 examined, 85 contained the bacillus.

The results of these counts in healthy and diseased bees are shown in the accompanying table :—

No	Bacteria counted	
	In Healthy Bees.	In Diseased Bees.
1	20	63
2	10	182†
3	13	65
4	20	110
5	24	135
6	12	125†
7	20	592
8	18	178†
9	27	180
10	13	463
11	14	385
12	47	391†
13	9	293†
14	11	125†
15	21	183
16	—	247
17	—	287†
Average	18	229

† Indicates that *B. pestiformis apis* was present.

The healthy bees were kept shut up in small boxes for twenty-four hours before being killed, in order that they might be subjected as nearly as possible to the same conditions as the infected bees, which had all been sent by post.

The bacteria noted were of several different kinds.

In some cases a long, thin bacillus was the prevailing organism, and it was present in several others. In some instances it formed small, zooglea masses of a rosette shape. This bacillus has been constantly noted in the small intestine and colon of healthy and diseased bees, being one of the commonest of the normal intestinal flora. Among the other bacteria noted were micrococci, and in a few instances yeast cells.

In all the diseased specimens *Nosema* was first ascertained to be present before proceeding with a count. The bacteria observed included all those seen in healthy bees, and in addition the *B. pestiformis apis* was found in seven (41 per cent.) out of the seventeen specimens examined.

From the table it will be seen that the number of bacteria present in diseased bees was much greater than in the normal ones, the proportions being 12 to 1 in favour of the former.

This great increase in the bacterial content of the chyle stomach is perhaps due to an alteration in the normal reaction of the gastric juice, which in the healthy bee is such as to prevent the growth of most bacteria. The presence of *Nosema* in many of the secreting cells possibly tends to produce some alteration in the composition of the gastric fluid favourable to the growth of bacteria.

The presence of *B. pestiformis apis* in a considerable number of the infected bees and its absence from the normal ones is a point which must be considered.

As has been stated previously, this organism is non-pathogenic *per se*, but it is not one of the normal gastric flora of the bee. There is no doubt that all animals, including bees, swallow large numbers of bacteria with their food, which are quickly killed in the alimentary canal or ejected with the fæces. It would appear probable that *B. pestiformis apis* is one of those organisms which is capable of effecting a lodgment in the alimentary canal of the diseased bee, and of playing the part of a secondary infecting agent, in a manner that is familiar to bacteriological students of human and animal diseases. It is quite possible that other organisms, even some of those which are normal inhabitants of the alimentary tract in the bee, may also take on a secondary pathogenic action when the resisting powers of the gastric mucous membrane have been lowered by the action of the invading parasite (*Nosema*). This would account for the large numbers present in the chyle stomachs of infected bees as compared with the numbers present in those of healthy ones.

Bacteriology of Bee Paralyis.

It is not improbable that many, if not all, the cases of so-called bee paralysis are in reality cases of the disease under consideration. The results of bacteriological investigations into this complaint are therefore of interest. In 1903 *White* (1906, p. 44) in New York State examined a number of bees from hives suffering from paralysis. He isolated several species of bacteria, and made some experimental inoculations, but was unable to arrive at any conclusions as to the cause of the disorder. Many of the organisms which he cultivated proved to belong to the normal flora of the bee's intestine.

Cheshire (p. 569) described an organism which he stated was constantly present in bees suffering from a complaint which resembled paralysis. This organism he named *B. Gaytoni.* He describes it as a short, rounded bacillus, almost coccoid in shape, which produced characteristic lobulated colonies on gelatin with subsequent liquefaction of the medium. He does not state that polar staining occurs, but in other respects the organism he describes much resembles *B. pestiformis apis,* and may possibly be identical with it.

Brown (15, vii, 1911), working in Australia, states that he has found an organism which he considers to be the cause of bee paralysis. It is a short, round-ended, motile bacillus, and was found in all the bees suffering from paralysis which were examined. Impure broth cultures of this organism, when injected into guinea-pigs and rabbits, were fatal in from twenty-four hours to five days in some cases, but in other cases the animals recovered after severe illness. The organism was recovered from the heart blood of a guinea-pig, and on several occasions from cultures from infected bees, and mixed with syrup and fed to healthy bees. Paralysis was produced in the experimental bees in a few days. Silkworms were fed on mulberry leaves smeared with cultures of the organism; several of them died in a few days, and a rabbit was inoculated with the contents of the dead silkworms' intestines. This animal died in twenty-four hours, and the organism was recovered from its heart's blood.

Brown does not give any details of the morphology or cultural peculiarities of this bacillus, but from its being motile it is improbable that it is *B. pestiformis apis,* which is a non-motile organism.

Laidlow (15, viii, 11), on the other hand, makes the following statement: "In my examinations I found that the bacterial fluval in bees from healthy and from dwindling colonies are practically the same, and in the few cultivations I made I detected no special organism that would account for either spring dwindling or paralysis."

Bacteriology of other Bee Diseases.

Brood diseases have been carefully studied, not only in this country, but also in Germany, Switzerland, the United States of America, and other countries, and it is now generally admitted that there are at least two distinct forms of disease which affect the larvæ, and which are provisionally known as European and American foul-brood, though both forms occur in Europe and America. Cheshire and Cheyne described an organism which they found constantly present in larvæ which died from this complaint, and named it *B. alvei.* It is a motile spore-bearing bacillus which forms very characteristic colonies with branching prolongations on gelatin. The authors claim that they were able to infect healthy brood by spraying with pure cultures of this organism, but other observers have been unable to obtain similar results. In 1908, *White* in America described an organism which he named *B. larvæ,* and stated that this spore-bearing organism with peculiar oxygen requirements was undoubtedly the cause of American foul-brood. Shortly after this, *Maassen* (1909) described a similar organism in Germany, and called it *B. brandenburgiensis.* This bacillus is probably the same as the organism described by White. Maassen and Burri have independently described organisms which they consider to be the causative agents of other brood diseases. In fact, at the present time the relationship of bacteria to brood diseases is very uncertain.

SECTION XIII.

NOTE ON CERTAIN PROTOZOA FOUND IN BEES.

By H. B. FANTHAM, D.Sc., B.A., and ANNIE PORTER, D.Sc.

During the course of our investigations, we have at various times found protozoa, other than *Nosema apis,* in hive bees. These organisms occurred in very few bees, many of which were quite healthy. Some came from districts where disease among bees was quite unknown. The parasites, when present, were usually few in number, and there is no evidence whatever to show that they were injurious to the bees.

Entamœba apis has been found in a few bees in relatively large numbers. It strongly resembles *Entamœba coli,* a harmless parasite from the human intestine. It moves fairly quickly by the protrusion of pseudopodia, and is distinguished by the rapidity with which it may become rounded and encysted.

Gregarines.—Two species of gregarines have been encountered, one species being much larger than the other. Conjugation and syzygy (chain formation) have been seen in life. The gregarines are apparently harmless.

Flagellates.—A species of *Crithidia* has been observed on rare occasions, and also a *Herpetomonas*—both recorded by us for the first time from bees. They have the typical life-cycle, forming pre-flagellate, flagellate, and post-flagellate stages. On no occasion was there a heavy infection with either parasite, and only about a dozen bees out of all those which we have examined have contained these organisms.

A new *spirochaete* has also been seen on very rare occasions in the chyle-stomach and hind gut of bees, which apparently were healthy. The organism is a typical spirochæte, with narrow, sinuous body and rapid movements. It seems to be quite harmless.

The parasites just enumerated were usually found in small numbers, and were present in a very small proportion of the bees examined. We are therefore of opinion that they have no connection with the Isle of Wight disease.

BIBLIOGRAPHY

A. W. (1906). Correspondence. *B.B.J.* Vol. xxxiv., p. 319.

A. W. (15, ii., 1912). Heather honey as winter food. *B.B.J.* Vol. xl., p. 66.

Aristeus, Comfort to (Ca. 1800). (Copy in the possession of Mr. G. W. Bullamore.)

Avery, G.W. (14, iv., 1910). Foul-brood legislation. *B.B.J.* Vol. xxxviii., p. 145.

Bedell, C. W. (1, vii., 1909). Is it bee paralysis? *Gleanings in Bee Culture.* Vol. xxxvii., p. 412.

Beginner, A. (13, iii., 1902). Bees dying on the ground in spring. *B.B.J.* Vol. xxx., p. 108.

Berlepsch (1873). Cited by Zander. (1911.)

Bertrand, E. (1909). *Conduite du rucher.* p. 100. Genève.

Betts, A. D. (17, xi., 1910). Bees and flowers. *B.B.J.* Vol. xxxviii., p. 454. (See also *B.B.J.*, 1909, p. 334, and 1911, p. 484.

Beuhne, R. (15, viii., 1908). Beekeeping in Australia. *Gleanings in Bee Culture.* Vol. xxxvi., p. 998.

(1909). Spring losses of bees. Report of a paper read at the Conference of Victorian Apiarists' Assoc., 23, vi., 1909. *Australasian Bee-keeper*, xi., p. 10.

(15, viii., 1911). Bee diseases observations. *Australasian Bee-keeper.* Vol. xiii., p. 27.

Bevan, E. (1827). *The Honey Bee*, p. 184. London.

Bonner, J. (1795). *A new plan for speedily increasing the number of bee-hives.* Edinburgh.

Brighton, B. E. (13, vii., 1911). Queen surviving disease. *B.B.J.* Vol. xxxix., p. 275.

Brown, W. (15, vii., 1911). Paralysis or dysentery in bees. *Australasian Bee-keeper.* Vol. xiii., p. 5.

Browne, C. A. (1908). Chemical analysis and composition of American honeys. *U.S. Dept. of Agriculture, Bureau of Chemistry,* Bull. 110, p. 11.

Burri, R. (1904). Bakteriologische Forschungen über die Faulbrut. *Schweizerische Bienen-zeitung,* Nos. 10, 11.

Buttel-Reepen, H. v. (1907). *Are bees reflex machines?* Translation by Mary M. Geisler. A. I. Root Co., Ohio.

Cheshire, F. R. (1886). *Bees and Bee-keeping.* Vol. I. Scientific. Vol ii., Practical. Upcott Gill.

Cobbett, L. (1907). *Royal Commission on Tuberculosis.* Second Interim Report, p. 1028.

Cooper, H. M. (1906). Bee paralysis. *B.B.J.* Vol. xxxiv., p. 56.

Cowan, T. W. (1890). *The Honey Bee.* Houlston and Sons.

(1907). *British Beekeepers' Guide Book.* 19th edition. Madgwick, Houlston and Sons.

Crawshaw, L. S. (5, v., 1910). Cappings of comb. *B.B.J.* Vol. xxxviii., p. 779.

Critchlow, B. P. (15, vii., 1904). *Gleanings in Bee Culture.* Vol. xxxii., p. 692.

D. M. M. (14, iii., 1905). Among the bees. *B.B.J.* Vol. xxxiii., p. 102 (6, vii., 1905), xxxiii., p. 262 (1906), xxxiv., pp. 312, 352 and (1911) xxxix, p. 145.

Dadant, C. (1907). *Langstroth on the hive and honey Bee.* (Revised by Dadant). Dadant and Sons, Illinois, U.S.A.

D'Autemarch (1911). Maladie de l'Ile de Wight. *L'Apiculteur.* Vol. lv., p. 196.

Desmarest. Cited by D'Autemarche (v., 1911).

Dönhoff and Leuckhart (1857), cited by Maassen (1911).

Doolittle, G. M. (15, i., 1912). *Gleanings in Bee Culture.* Vol. xl., p. 40.

(15, iii., 1912). See Stray Straws. *Gleanings in Bee Culture.* Vol. xl., p. 152.

Dyer, W. (1781). *The apiary laid open,* p. 58. Tewkesbury.

Dzierzon (1882). *Rational bee-keeping.* Translated by H. Dieck. P. 278. Houlston and Sons.

Editorials in *B.B.J.* referring to *Nosema* infection.
28, x., 1909, p. 421, vol. xxxvii.
25, v., 1911, p. 201, vol. xxxix.
10, viii., 1911, p. 311, vol. xxxix.
21, ix., 1911, p. 371, vol. xxxix.

Edwards (1909). *Buckinghamshire Bee-keepers' Assoc., Ann. Reports,* 1909, p. 5, and 1910, p. 6.

E. M. G. (31, iii., 1910). Isle of Wight Disease. *B.B.J.* xxxviii., p. 126.

Fairbrother, E. (3, vi., 1862). *Journ. of Horticulture,* pp. 187, 245.

Fantham, H. B. (1911). Coccidiosis. *The Grouse in Health and Disease.* Chap. xi., p. 234. Smith, Elder and Co.

Fantham, H. B., and Annie Porter (1911). A bee-disease due to a protozoal parasite (*Nosema apis*). *Proc. Zoo. Soc.,* Lond., p. 625.

(4, iv., 1911). *Nosema apis Abstracts. Proc. Zoo. Soc.,* Lond., No. 94.

Fawell, J. J. (1909). A strange loss of bees in August. *Gleanings in Bee Culture.* Vol. xxxvii., p. 744.

G. W. G. (28, vi., 1906). *B.B.J.* Vol. xxxiv., p. 260.

Garrett, E. E. (15, vii., 1910). Report of Victorian Apiarists' Assoc. Annual Conference in *Aurtralasian Bee-keeper.* Vol. xii., p. 1.

H. M. C. (vi., 1906). Paralysis. *Irish Bee Journal.* Vol. vi., p. 18.

H. S. (26, iii., 1908). More light wanted. *B.B.J.* Vol. xxxvi., p. 126.

Hannemann (1909). Cited by Zander (1911).

Harrison, F. C. (1900). Foul brood of bees. *Ontario Agricultural College.* Bull. 112, p. 2.

Hein, W. (1911). See Editorial, *B.B.J.* (21, ix., 1911). xxxix, p. 371.

Higgins, H. (1858). Death of the common hive bee supposed to be occasioned by a parasitic fungus. *Journ. Proc. Linn. Soc.* Vol. iii. (Zool.), p. 29.

Huish, R. (1821). *Cottagers' manual of management of bees.* 2nd edit. London.

(1844). *Bees.* H. G. Bohn. London.

Imms, A. D. (vi., 1907). Report on a disease of bees in the Isle of Wight. *Journ. of Board of Agriculture.* Vol. xiv., p. 129.

J. H. (1906). Correspondence. *B.B.J.* Vol. xxxiv., p. 229.

Keys, J. (1780). *Practical Bee-master.* London, p. 300.

Laidlow, W. (15, viii., 1911). Bee diseases investigation. *Australasian Bee-keeper,* xiii., p. 22.

Lanarkshire Bee-keeper (21, v.., 1889, and 12, vii., 1894, p. 46). *Journal of Horticulture.*

Langstroth (1907). *The hive and the honey bee.* Dadant and Sons, Illinois.

Léger, L., and Hesse, E. (1907). Sur une nouvelle Myxosporidie parasite de la Sardine. *Compt. rend., Acad. Sci.,* T. 145, pp. 85, 87.

Leuckhart (1860). *Bienen Zeitung,* p. 232. Cited by Harrison (1900), p. 2.

Loveday (14, vi., 1906). Vagrant Swarms in London. *B.B.J.* Vol. xxxiv., p. 233.

Leydig (1863), cited by Maassen (1911).

Maassen, A. (1909). *Ueber die durch den Namen "Faulbrut" bekannten seuchenshaften Bruterkrankungen der Honigbiene.* Parey, Berlin. (See also Editorial (9, xii., 1909), *B.B.J.,* xxxvii., p. 481.

(1911). Zur Aetiologie und Epidemiologie der Ruhr bei den Bienenvölkern. *Mitteilungen a. d. Kaiserlichen Biologischen Anstalt für Land- und Fortswirtschaft,* p. 50.

Maassen and Nithack (1910). Über die Ruhr der Bienen. *Ibid.,* p. 39.

Macdonald, D. M. (24, ii., 1910). *B.B.J.* xxxviii., p. 80.

(26, x., 1911). *B.B.J.,* xxxix., p. 428. (15, i., 1912), Isle of Wight Bee Disease. *Gleanings in Bee Culture.* Vol. xl., p. 41.

Malden, W. (ii., 1909). Further report on a disease of bees in the Isle of Wight. *Journ. of the Board of Agriculture.* Vol. xv., p. 809.

Mathewson, H. (1, ii., 1912). The question of wintering and spring protection. *The Bee-keepers' Review.* Vol. xxv., p. 47.

Mill, H. R. (1911). *British Rainfall,* 1910. Vol. L., Part. ii. Edw. Stanford, London.

Miller, A. C. (x., 1911). Bee behaviour. *Gleanings in Bee Culture.* Vol. xxxix., p. 663.

(i., 1912). A few random notes on the ways bees "make" honey. *Gleanings in Bee Culture.* Vol. xl., p. 23.

Miner, T. B. (1849). *American Bee-keepers' Manual.* Wiley and Sons, London.

Moroney, W. (ix., 1903). *Irish Bee Journal,* p. 60.

Neighbour, A. (1878). *The Apiary.* Third edition, pp. 129–130.

Nussbaumer, T. (1912). Einige Erfahrungen über die Nosemakrankheit. *Schweizerischen Bienenzeitung.* (Reprint.)

Old Sarum (1905). Correspondence. *B.B.J.* Vol. xxxiii., p. 178.

Pettigrew (1870). *The handy book of bees.* W. Blackwood and Sons.

Phillips, E. F. (1906). The brood diseases of bees. *U.S. Dept. of Agriculture, Bureau of Entomology,* Circular No. 79.

(viii., 1910). *The habits of the honey bee.* A. I. Root Co., Ohio.

(1911). The treatment of bee diseases. *U.S. Dept. of Agriculture. Farmers' Bulletin,* No. 442, p. 21.

Pons, M. (v., 1911). Paralysie des Abeilles. *L'Apiculteur.* Vol. lv., p. 201.

Puzzled (24, xi., 1902). *B.B.J.* Vol. xxxi., p. 388.

Queen Bee (19, vii., 1906). A problem in swarms. *B.B.J.* Vol. xxxiv. p. 282.

Reed, C. (1906). Bee paralysis. *B.B.J.* Vol. xxxiv., p. 44.

Root, A. I. and E.R. (1910). *The A.B.C. and X.Y.Z. of Bee Culture.* The A. I. Root Co., Ohio.

Silver, J. (vii., 1907). Bee disease in the Isle of Wight. *Irish Bee Journ.* Vol. vii., p. 25.

Simmins, S. (5, x., 1911). Bees' wing power and *Nosema apis.* *B.B.J.* Vol. xxxix., p. 395.

Sladen, F. W. L. (14, xii., 1911). How pollen is collected by the social bees, and the part played in the process by the auricle. *B.B.J.* xxxix., pp. 492–506.

Snodgrass, R. E. (1910). The Anatomy of the honey bee. *U.S. Dept. of Agriculture, Bureau of Entomology, Tech. series, No.* 18.

Stapleton, T. (27, iv., 1911). Dealing with Isle of Wight Disease. *B.B.J.* Vol. xxxix., p. 106.

Stempell, W. (1909). Ueber *Nosema bombycis,* Nägeli. *Arch. f. Protistenkunde.* Vol. xvi., pp. 281–358.

T. D. N. (1, ii., 1912). *B.B.J.* Vol. xl., p. 47.

Tegetmeier, W. B., cited by Neighbour (1878), p. 129.

Thomson, W. (1882). *An Essay on bees by "Pan."* W. Munro, Glasgow.

Vicat (1764). Cited by Wildman (1768).

White, G. F. (6, xi., 1906). The bacteria of the apiary. *U.S. Dept. of Agriculture, Bureau of Entomology*, Tech. Series, No. 14.

(15, vii., 1907). The cause of American foul brood. *U.S. Dept. of Agriculture, Bureau of Entomology*, Circular No. 94.

(1908). The relation of the etiology (cause) of bee-disease to treatment. *U.S. Dept. of Agriculture, Bureau of Entomology*, Bull. 75, Part. iv.

Wildman, T. A. (1768). *A treatise on the management of bees.* London.

Woodbury (11, viii., 1863). "A Devonshire Bee-keeper." *Journ. of Horticulture.* (See also in this Journal correspondence on foul brood, 1862 and 1863.)

Woodley, W. (12, v., 1910). Notes by the way. *B.B.J.* Vol. xxxviii., p. 190.

Yank, S. (25, i., 1906). Bee-keeping experiences. *B.B.J.* Vol. xxxiv., p. 3.

Zander, E. (1909). *Tierische Parasiten als Krankheitserreger bei der Biene.* Siegfried and Co. Munich.

(14, iv., 1912). *Nosema apis* in Australia. *B.B.J.* Vol. xxxviii., p. 144.

(1911). Krankheiten und Schädlinge der erwachsenen Bienen. *Handbuch der Bienenkunde.* Vol. ii.

Richard Clay and Sons, Limited,
BRUNSWICK STREET, STAMFORD STREET, S.E.
AND BUNGAY, SUFFOLK.

Supplement
TO
The Journal
OF THE
BOARD OF AGRICULTURE

SUPPLEMENT No. 9. AUGUST, 1912.

NOTES ON KERRY WOODS
Illustrating Methods of
COLLECTING AND UTILISING INFORMATION
for a
FOREST SURVEY

LONDON
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE
BY R. CLAY & SONS, LTD., BRUNSWICK STREET, STAMFORD STREET, LONDON, S.E.,
AND PUBLISHED BY THE BOARD OF AGRICULTURE AND FISHERIES

SUPPLEMENTS TO THE JOURNAL OF THE BOARD OF AGRICULTURE.

No. 1.—Report on Agricultural Education in the United States	Jan., 1908
No. 2.—The Food of Some British Birds ...	Dec., 1908
No. 3.—Reports on the Work of the International Agricultural Institute ...	April, 1910
No. 4.—Wheat: Papers Read at a Meeting of the British Association at Winnipeg, 1909	June, 1910
No. 5.—Influence on the Production of Mutton of Manures Applied to Pasture ...	Jan., 1911
No. 6.—Report on the Work of the International Agricultural Institute ...	July, 1911
No. 7.—The Interpretation of the Results of Agricultural Experiments	Nov., 1911
No. 8.—Report on the Isle of Wight Bee Disease	May, 1912
No. 9.—Notes on Kerry Woods. Illustrating Methods of Collecting and Utilising Information for a Forest Survey ...	Aug., 1912

THE Board of Agriculture and Fisheries are collecting, as opportunities arise, reliable data relating to forestry and afforestation, and as an example of one of the types of information considered desirable, the reader is referred to the account of the Coombe Plantation in the Board's *Journal* for July and August, 1910, Vol. XVII., pp. 265–283 and 353–370.

The data collected in any one locality will, as a rule, be incomplete, but it is hoped that, as the work of investigation progresses, it may be found possible to co-ordinate the results into a form which will be a useful and fairly complete guide to those undertaking planting operations.

In publishing the following investigations into the growth of timber on mountain soils, the Board desire to thank the executors of the estate of the late John Naylor, Esq., for permission to visit and measure woods and to fell sample trees on the Brynllywarch Estate; and also the agent, Mr. P. Hurlbutt, and the sub-agents, Messrs. Burn-Callendar and Beadon, for valuable assistance in carrying out the work.

BOARD OF AGRICULTURE AND FISHERIES,
4, WHITEHALL PLACE,
LONDON, S.W.

August, 1912.

CONTENTS

PAGE
I.—INTRODUCTION 6
Topography, Climate, Geology, and Soil.

II.—METHODS OF MEASUREMENT AND DETAILS OF GROWTH OF DIFFERENT SPECIES 11
A. Larch. Effect of Elevation, Effect of Wind, Future Development of Sample Groups, the Larch on Exposed Slopes, Summary ... 12
B. Scotch Pine 21
C. Spruce. Sample Groups 22
D. Miscellaneous Species and Mixtures of Species 27
1. Corsican Pine. 2. Douglas Fir with Larch. 3. Douglas Fir with *Abies grandis* and Larch. 4. Larch, Scotch Pine and Spruce. 5. Various Exotic Conifers.
E. The Relative Rates of Height Growth of the different Species 29
F. Quality of the Timber 30

III.—UTILISATION OF THE DATA FOR A SURVEY 32
A. Method of Arriving at a Basis for a Survey ... 32
General Considerations. Use of Yield Tables. Comparison of Sample Plots with Schiffel's Tables. Degree of Approximation Attained. Yield Tables Employed. Application of Results of a Survey to Afforestation Schemes.
B. Systematic Method of Conducting a Survey ... 46
C. Summary 46

Appendix A.—Mechanical and Chemical Analyses of Soil Samples 50
Appendix B.—Details of Caliper Measurements of Sample Areas 54
Appendix C.—Volume and Money Yield Tables for Spruce (after Schiffel) 59
Appendix D.—Soil Expectation Values for Spruce 64

NOTES ON KERRY WOODS, ILLUSTRATING METHODS OF COLLECTING AND UTILISING INFORMATION FOR A FOREST SURVEY.

By R. L. ROBINSON.

I.—INTRODUCTION.

The investigations described in the following pages were, primarily, undertaken with the object of obtaining some accurate figures relating to the growth of timber in one of the more hilly districts of Wales. Later, when it was found that the results were of some value for the purpose, the scope of the work was extended to comprise a small survey of adjacent hill land in order to estimate its suitability for forestry purposes, and to settle the lines on which a forestry survey on a large scale should proceed.

The woods described lie chiefly on the Brynllywarch Estate on the boundaries of Radnor, Montgomery and Salop. The total area of the estate is about 7,000 acres, of which approximately 2,000 acres are wooded.

In beginning the work a preliminary inspection was first made of all the woods, and their general characteristics noted. Those plantations most likely to yield useful information were then gone over in detail, sample plots were laid out and measured, and soil samples submitted to mechanical and chemical analysis. The information collected was then critically examined, and was made to form the basis for the survey and valuation for forestry purposes of similar adjacent hill land.

TOPOGRAPHY.

The key to the local topography is Kerry Hill, which runs as a long ridge in an E.N.E. and W.S.W. direction at an elevation of from 1490—1570 feet. Kerry Hill is part of a long spur which runs out from the high land lying on the borders of Cardigan, Radnor and Montgomery to the west.

The nearest point on the western sea-coast is about 35 miles distant. The intervening country is mountainous, the culminating point being Plynlimon Fawr (2,468 feet), but on the average the highest land rises to about 1,750 feet. From the top of Kerry

Hill the land slopes steeply to the north, but towards the south the slope is gentler.

CLIMATE.

The district lies on the edge of the very wet belt to the west. The rainfall at Newtown, under very similar conditions to Kerry, is about 40 inches, but westwards the rainfall gradually increases until it reaches 70 or 80 inches at Rhayader. The rainfall, therefore, on the higher land and southern slopes in this district is probably about 50 inches.

The snow-fall is irregular, considerable quantities falling in some winters and practically none in others.

Wind is undoubtedly the chief meteorological factor governing the growth of trees in this district. Frost is not a serious enemy. As pointed out above, Kerry Hill lies on the sheltered side of the central Welsh mountains, but the actual shelter obtained on the top of the hill appears to be very small. Cilfaesty Hill, 3 miles to the west of the woods under observation, rises to 1,760 feet, but to the south and south-west the hills are lower than Kerry Hill and the top of the latter is very bleak and fully exposed to the persistent S.W. and W. winds. The northern slopes are very well sheltered, but the southern are very exposed.

GEOLOGY.

In this district three series of rocks, all of sedimentary origin, come under consideration :—

1. Wenlock Shales.
2. Ludlow Shales.
3. The Old Red Sandstone.

The first two series, of Silurian age, form part of an anticlinal fold which further to the N.E. brings the Ordovician and Cambrian rocks to the surface.

The woods are chiefly on the Ludlow series, which are here rather thin-bedded shales. The Wenlock shales are lithologically similar but thinner, while the Old Red Sandstone series consists of red marls and grey sandstones. The whole three formations dip to the southward at an angle varying from 20° to 55°.

THE SOIL.

The soil, which is the weathered produce of the underlying rocks is, broadly speaking, on the shales, a yellowish brown loam and, on the sandstones as far as the timbered area is concerned, a red clay. Here and there in the lower parts of the valley are small deposits of glacial origin.

The soil generally is of good depth, overlying a rubbly subsoil composed of fine earth and fragments of shale. In the clays overlying the Red Sandstone there is no differentiation into soil and subsoil at a depth of 3 ft.

To obtain accurate information as to the nature of the soils, composite samples were taken of the soil and of the subsoil from a number of holes on some of the sample plots. The mechanical and chemical analyses of these were made at the Government Laboratory under the kind supervision of Dr. Dobbie. The methods of analysis used were those described in Hall and Russell's *Agriculture and Soils of Kent, Surrey and Sussex.**

The following statement gives particulars of the samples and of the geological and sylvicultural conditions under which they were taken. The number of each soil sample corresponds with a volume sample plot, the depth of sampling being indicated in the fourth column of the table below.

Sample.	Geological Formation.	Elevation. O.D.	Depth of		Crop on Ground.	Surface Covering.	Remarks.
			Soil.	Subsoil.			
		feet.	inches.	inches.			
1 A	Ludlow shales	1,020	9	∞*	Pure spruce	Spruce needles	Soil, wash from slopes above. Surface flat
2	,,	1,460	4—6	6—12	60 year old Scotch pine	Coarse grass on 6 in. peat	Gentle slope
3	,,	1,460	4—9	9—12	Pure spruce	Spruce needles on 2–6 in. peat	Gentle slope
5 and 6	,,	1,525	4—9	3—9	Spruce	Spruce needles on 4 in. peaty humus	Gentle slope
8	,,	1,300	24	12	Spruce	Spruce needles	Steep
9	,,	1,530	3—6	12	Spruce	Spruce needles on 6–8 in. peat	Gentle slope
A	,,	1,560	5	12	Very irregular. spruce	Heather on 4–5 in. peat	Flat
L_1	,,	975	15–22	∞	23 year old Larch	Larch needles	Thin sprinkling of wood sorrel on ground. Flat
L_3	,,	1,175	24	∞	23 year old Larch	Larch needles	Thin sprinkling of wood sorrel. Steep
L_4	,,	1,250	10	3	19 year old Larch	Larch needles	Thin sprinkling of wood sorrel. Steep
L_6	,,	1,435	10—12	8—10	19 Year old Larch and mixed conifers	Grass	Gentle slope
12	Old red sandstone	1,400	∞		20 year old mixed conifers	Coarse grass on 6–8 in. peat	Irregular crop Scotch Pine, Spruce and Larch. Flat

*The symbol ∞ is used to indicate the depth of subsoil when the underlying solid rock was not reached at 3 feet depth.

The depth of soil generally is greater on the northern than on the southern slopes owing to the fact that the rocks dip steeply to the southwards, but even on the summit of the hills there is always a depth sufficient for tree growth.

Mechanical Analysis.—Table I. (*Appendix* A, *pp.* 50, 51) gives the results of the mechanical analyses of the samples described above. Sample IA consisted chiefly of fragments of shale and contained very little clay (2·2 per cent.) or fine silt (4·4 per cent.). The soil was evidently the debris washed down by an adjacent stream. It is remarkable chiefly because of the excellent growth of spruce on it (see Group IA, p. 23). The remaining soils from the Ludlow Shales, conform, as nearly as one could expect, to a type, considering the large area from which they were selected. The average composition of these 10 samples is given below.

---

* Published by the Board, 2*s.* 6*d.* net., post free.

AVERAGE MECHANICAL ANALYSIS OF SOIL ON LUDLOW SHALE.

Character of Constituent.	Soil.	Subsoil.	Range of Variation. Soil.	Range of Variation. Subsoil.
Stones above 3 mm. to 100 parts of fine earth.	57	116	25—90	67—170
Percentage of fine earth :—	per cent.	per cent.	per cent.	per cent.
Fine gravel, above 1 mm.	4·2	6·9	0·7—14·1	1·6—16·0
Coarse sand, 1—0·2 mm.	3·0	5·7	1·3— 7·6	1·9—10·5
Fine sand, 0·2—0·04 mm.	9·7	12·9	4·1—15·2	6·7—21·9
Silt, 0·04—0·01 mm.	30·8	31·5	25·9—34·7	28·1—36·5
Fine silt, 0·01—0·005 mm.... ...	15·3	13·6	12·0—19·5	11·3—15·4
,, 0·005—0·002 mm. ...	9·4	7·5	4·9—12·1	6·1— 9·7
Clay, below 0·002 mm.	11·2	13·0	6·9—16·1	9·4—17·0
Moisture...	2·5	15·4	1·6— 3·7	1·0— 2·3
Loss on ignition	9·7	5·2	5·8—15·6	2·4— 7·5
Calcium Carbonate soluble in N/5HCl.	2·2	1·5	1·6— 3·0	0·9— 2·1
	99·1	99·4	—	—

This composition shows the soil to be of a texture which is very suitable for the growth of trees.

Chemical Analysis.—The results of the chemical analysis are given in Table II (*Appendix A*, pp. 52 and 53). As a general rule it may be stated that the chemical composition of a soil is of very much less importance in the case of forest trees, where the produce of the soil is removed only at very long intervals of time, than in the case of agricultural crops.

Provided that the soil is of good mechanical composition, sufficient depth and protected by a proper canopy, trees will thrive, in the presence of sufficient moisture, on soils extremely poor in mineral food. For instance, Henry * gives the following analyses as typical of the dunes of Gascony, where the soil on an average carries 1,760 cub. ft. of maritime pine (130 trees) per acre at an age of 75 years:—

---

* "Les Sols Forestiers," *Annales de la Science Agronomique,* 1907, Vol. ii., pp. 246 and 307.

	Water.	Loss on Ignition.	Al_2O_3. Fe_2O_3.	CaO.	MgO.	K_2O.	P_2O_5.	Insoluble in Acid.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Soil ...	1·47	5·85	0·05	0·03	0·24	0·04	0·02	92·3
Alios ...	2·17	3·00	1·63	0·03	0·27	0·04	0·05	92·8
Lower Sands	0·44	0·28	0·47	0·02	0·02	0·03	0·04	98·9

This soil consists of over 90 per cent. pure sand with extremely small quantities of lime, potash and phosphoric acid.

Ramann † states that the greatest use of chemical analyses in connection with forestry is for peaty soils. The quantities of mineral salts are in such cases a very good guide to the productiveness of the soil. With very sandy soils, according to Schütze, the chief factor governing the yield is the soil content in mineral food.* Ramann summarises Schütze's results in the following table. The quality classes refer to Scotch pine, I. being the best and V. the worst.

Quality Class.	Soluble in boiling HCl.			Phosphoric Acid.	Humus.
	CaO.	MgO.	K_2O.		
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
I.	1·8876	0·0484	0·0457	0·0501	0·892
II.	0·1622	0·0716	0·0632	0·0569	0·555
II.—III.	0·1224	0·0981	0·1235	0·0464	1·401
III.	0·0963	0·0800	0·0392	0·0388	1·825
IV.	0·0270	0·0505	0·0241	0·0299	1·524
V.	0·0433	0·0438	0·0215	0·0236	1·429

From this table it appears that the soils richest in lime and phosphoric acid yield the greatest volume of timber, but that variations in the quantities of potash and humus are of little moment.

With heavier soils, however, the results of chemical analyses are of less use. The effect of varying quantities of mineral salts is masked by other factors such as mechanical composition and general condition.

The analyses of the soils from Kerry show that they are rich in plant food except as regards nitrogen and lime. The total amount of potash present varies, as regards the soils on the Ludlow Shales, from 1·03 per cent. to 0·61 per cent. in the soil and from 0·91 per cent. to 0·65 per cent. in the subsoil. For total phosphoric acid the figures are, soil 0·22 per cent. to 0·10 per cent.; subsoil 0·187 per cent. to 0·09 per cent.; for nitrogen, soil 0·46 to nil, and subsoil 0·147 to nil.

---

† *Bodenkunde*, 1905, p. 203.

* The present state of knowledge on the subject is, however, unsatisfactory, recent experiments tending to disprove Schütze's conclusions (see *Int. Mitt. für Bodenkunde*, *Band I*, 1912, *Heft.* 6).

The amount of "available" potash and phosphoric acid in the soil is, with the possible exception of No. 12, sufficient to grow agricultural crops and amply sufficient for forest growth. In fact, small areas of land are under cultivation on the north side of Kerry Hill up to an elevation of about 1,350 ft., and on the south side up to about 1,400 ft., the chief crops being oats, turnips, swedes, and potatoes.

Nitrogen appears to be very generally absent from the soils, and in two cases, No. 8 (54-year old spruce) and No. 12 (bare), from both soil and subsoil. No. 1A, which carried a very fine crop of 43-year old spruce, shows a large amount of nitrogen (0·228 per cent. in soil and 0·147 per cent. in subsoil), but many of the soils carrying good close-canopied crops, *e.g.* Nos. L_1, L_3, 3, 5, 8, and 9, show only traces of this element in the soil or subsoil.

The chief point which these analyses show is that the soil is not appreciably poorer at higher than at lower elevations. For example, sample L_1 (975 ft.) growing a very fine crop of young larch, is in no wise better than No. 9 (1,530 ft.) under a 38 year old crop of spruce.

On Kerry Hill the soil first begins to get peaty at about 1,400 ft. and at higher elevations there is very generally a layer of 4–8 inches of peaty material. In such case heather is the most abundant plant on the rough grazing land.

A general review of the chemical and mechanical constitution of these samples indicates that the soils throughout are excellently adapted for the growth of timber.

II.—METHODS OF MEASUREMENT AND DETAILS OF GROWTH OF DIFFERENT SPECIES.

Two fairly distinct series of woods come under consideration. First, a large area planted some 20–25 years, and second, a smaller area of 40–60 years of age. Larch is the predominant species, either pure or in mixture with various other species, while Scotch pine and spruce have been grown both in mixture with the above on a large scale and pure in comparatively small groups.

The preliminary inspection of the woods brought out several facts clearly. In the first place, it was obvious that Scotch pine when grown pure is nowhere a success, and is the less flourishing the greater the elevation. Larch, on the other hand, thrives wonderfully on the sheltered localities, but above a certain elevation suffers so badly from the effects of wind that it is impossible to raise a successful crop. Spruce grows well at all elevations and in exposed situations seemed the only tree capable of yielding timber of a useful size.

In the detailed examination small plots of 0·1 to 0·3 acre in extent were laid out for each species, the diameters were calipered, and a sample tree, approximating as nearly as convenient to the mean tree, was felled. In selecting each sample plot an endeavour was made to secure uniformity of stocking in the crop and a fair average sample.

The sample tree was then cut up into sections of either 4 feet or 5 feet length, the rings at each section were counted and two diameters at right angles measured. From these data, it was then possible to find the volume of the sample tree and hence the form-factor, and further to trace the height-growth curve.

The volume per acre (V) was then calculated as

$$V = A \times h \times f,$$

where A = total basal area at breast height of dominant crop,
f = form factor of sample tree,
and h = mean height of dominant crop.

By the dominant crop is meant those trees which would remain on the ground after a thinning. In the case of larch and Scotch and Corsican pines, the imaginary thinning was of moderate intensity, only the suppressed trees being removed, while in the case of spruce the thinning was made to approximate in intensity (as will appear later) to the density in which the crop had hitherto been grown. The trees which would be removed are termed the minor crop. Such a division is necessary where woods are thinned at irregular periods if the results of an investigation are to be of any use for comparative purposes. The volume calculated in this way makes no great pretence to accuracy, since it is difficult to select with precision a sample tree fully representative of the mean tree of the crop.

By felling a greater number of sample trees the volume may be calculated with greater accuracy, but in the present case this was impossible. The volume is, unless otherwise stated, given as true volume including bark.

Each of the species examined will now be dealt with in turn.*

A. **Larch.**

For the investigation into the growth of larch, there was a great deal of material available, both young and mature woods, in sheltered and in exposed localities.

In consideration of the facts that the development of larch is poor here in exposed localities and that the mature woods are not properly stocked, it was decided to measure a series of groups at various elevations in a wood known as Cwm Golog 20–24 years old, and to check the height-growth development of the group sample trees by felling other sample trees among the maturer crops at various elevations.

Cwm Golog occupies a steep northern slope and is sheltered in its lowest parts both to the east and the west by flanking hills. The original crop was obviously a mixture of larch in lines 8 feet apart filled up to 4 feet with Scotch pine, spruce, silver fir, and Corsican pine. The larch has grown so vigorously, however, especially in the lower parts, that all the other species have been killed out and a pure crop is the result. This point is referred to again later.

The following is a description of the various groups :—

GROUP L_1†

Area, 0·3 acre. *Elevation,* 975 feet. *Age,* 23 years.

This Group lies at the foot of a steep slope on deep well-drained loam. Aspect N. The conditions are very favourable for the growth of larch.

---

* Most of the sample areas were girthed at breast height in the first instance, but it was considered more suitable to rely on caliper measurements, and the trees were consequently calipered after a year's growth had taken place. These latter figures have been utilised in applying the formula $V = A f h$. The value of the form factor is taken as that of the previous year.

The increase in height during the year has been read off from the height-growth curves of the sample trees. In most cases, therefore, it will be noticed that the value of h used is slightly greater in the formula for calculating the volume than for the sample tree.

† Details are given of the stem diameters for each sample plot in Appendix B., pp. 54–58.

Dominant trees per acre (of mean diameter 6·7 in.)	450
Minor trees per acre (of mean diameter 4·9 in.) ...	100
Total trees per acre	550

There were three Douglas firs on the sample plot, which were counted as dominant larch.

Sample tree: Total length (h) = 44 feet 6 inches.
Diameter breast height (d) = 6·4 inches.
True Volume to 3 inches least diameter (v) = 4·6 cubic feet.
Form factor (f) = 0·470.

Volume per acre $= \frac{32{\cdot}43}{0{\cdot}3} \times 46{\cdot}5\,^{*} \times 0{\cdot}47 = 2{,}360$ cub. ft. approx.

As remnants of the former crop there were also standing on this plot 80 spruce per acre of a height of from 4 feet to 10 feet. They were very thin in foliage and showed little promise of developing into trees. All the Corsican and Scotch pines were dead, but three Douglas firs had attained a height of about 50 feet.

GROUP L_2.

Area, 0·156 acre. *Elevation*, 1,080 feet. *Age*, 23 years.

Fairly steep slope. Soil deep and well drained loam. Aspect N.

Dominant trees per acre (of a mean diameter 6·0 in.)	545
Minor trees per acre (of a mean diameter 4·2 in.) ...	160
Total trees per acre	705

Sample tree: h = 40 feet 7 inches. d = 5·6 inches.
v = 3·5 cubic feet. f = 0·504.

Volume per acre $= \frac{16{\cdot}81}{0{\cdot}156} \times 42{\cdot}25 \times 0{\cdot}504 = 2{,}280$ cub. ft. approx.

There were also present 40 small spruce per acre, similar to those in Group L_1. The Scotch and Corsican pines were all dead.

GROUP L_3.

Area, 0·2 acre. *Elevation*, 1,175 feet. *Age*, 23 years.

Slope, steep. Soil and aspect as in Groups L_1 and L_2.

Rather irregular group.

Dominant trees per acre (of mean diameter 5·7 in.)	515
Minor trees per acre (of mean diameter 3·8 in.) ...	100
Total trees per acre	615

---

* See footnote as to the value of *h* on preceding page.

Sample tree: h = 37 feet 4 inches. d = 5·4 inches.
v = 3·05 cubic feet. f = 0·513.

Volume per acre = $\frac{18\cdot13}{0\cdot2} \times 38\cdot25 \times 0\cdot513 = 1{,}780$ cub. ft. approx.

Also present 20 small spruce per acre with the Scotch and Corsican pines all dead as in Groups L$_1$ and L$_2$.

GROUP L$_4$.

Area, 0·2 acre. *Elevation*, 1,250 feet. *Age*, 21 years.

Soil, slope and aspect as in Groups L$_2$ and L$_3$.

Dominant trees per acre (of mean diameter 5·8 in.)	470
Minor trees per acre (of mean diameter 4 in.) ...	200
Total trees per acre	670

Sample tree: h = 34 feet 8 inches. d = 5·45 inches.
v = 2·67 cubic feet. f = 0·476.

Volume per acre = $\frac{17\cdot6}{0\cdot2} \times 36\cdot3 \times 0\cdot476 = 1{,}520$ cub. feet. approx.

There were also present 45 spruce and 10 suppressed pines per acre. The spruce were mostly badly suppressed though a few were 12 feet high. The heavy early thinnings to which this group had been subjected account for the survival of the pines.

Between Groups L$_4$ and L$_5$ the slope becomes gentler and the wood is no longer sheltered to any extent by flanking hills to the west.

GROUP L$_5$.

Area, 0·18 acre. *Elevation*, 1,350 feet. *Age*, 20 years.

Aspect N. Slope gentle. Soil shallower than in foregoing groups.

Dominant trees per acre (of mean diameter 4·75 in.)	560
Minor " " (" " " 3·0 ")	100
Total per acre	660

Sample tree: h = 24 feet 2 inches. d = 4·85 inches.
v = 1·6 cubic feet. f = 0·512.

Volume per acre = $\frac{12\cdot37}{0\cdot18} \times 25\cdot5 \times 0\cdot512 = 900$ cub. feet approx.

Also present 150 spruce, 50 silver firs, 100 Scotch pines and 40 Corsican pines per acre. The two pines and the spruce are of practically the same height and rival the larch, while the silver firs are from 4 feet to 10 feet high.

MMARY OF LARCH GROUPS (FIGURES PER ACRE).

Group.	Age.	Elevation. O.D.	Dominant Crop.				Minor Crop.		Other Conifers Present.				
			Number of Trees.	Mean height.	Mean diameter.	Volume.	Number of Trees.	Mean diameter.	Spruce.	Scotch Pine.	Corsican Pine.	Silver Fir.	TOTAL.
	years	*feet*		*feet*	*in.*	*cub. ft.*		*in.*					
L_1	23	975	450	46·5	6·7	2,360	100	4·9	80	—	—	—	80
L_2	23	1,080	545	42·25	6·0	2,280	160	4·2	40	—	—	—	40
L_3	23	1,175	515	38·25	5·7	1,780	100	3·8	20	—	—	—	20
L_4	21	1,250	470	36·3	5·8	1,520	200	4·0	45	5	5	—	55
L_5	20	1,350	560	25·5	4·75	900	100	3·0	150	100	40	50	340
L_6	20	1,435	670	22·0	4·7	910	65	2·5	250	110	55	45	460

GROUP L_6.

Area, 0·2 acre. *Elevation*, 1,435 feet. *Age*, 20 years.
Aspect N.N.W. Slope gentle. Soil as in Group L_5.

Dominant trees per acre (of mean diameter 4·7 in.)	670	
Minor " " (" " 2·5 ")	65	
Total	735	trees per acre

No sample tree felled. Average height of larch 22 feet.

$$\textit{Volume per acre} = \frac{16{\cdot}12}{0{\cdot}2} \times 22 \times 0{\cdot}512 = 910 \text{ cub. feet approx.}$$

Also present 250 spruce, 110 Scotch pines, 45 silver firs and 55 Corsican pines per acre. These species show the same relative development as in Group L_5.

A comparison of the groups (see p. 15) shows that L_1, L_2, L_3 are of the same age, while L_4, L_5, and L_6 are younger, L_5 and L_6 being also of equal age. Only the first three groups therefore may be strictly compared. From the height-growth curves (see p. 20) it is easily possible to predict with fair accuracy the probable height and volume of all groups at the age of the oldest, viz. 23 years.

This has been done and the results graphically represented in the accompanying diagram (p. 17). The broken lines indicate a change in the age of the groups. The volume falls off gradually on the steep slopes ascending to Group L_4, after which the fall is very rapid. This rapid diminution in volume is obviously connected in an intimate way with the local topography. Groups L_1 to L_4 lie on a steep slope under as good conditions of shelter as it is possible to obtain at the given elevations. Above Group L_4 (1,250 feet), however, the slope becomes much gentler and the two remaining groups are somewhat exposed to cross winds, notwithstanding the fact that Kerry Hill rises 120 feet higher immediately to the windward.

The heights and diameters fall off in a very similar way to the volumes, with the exception of Group L_4, which shows slightly better growth than Group L_3 at a lower elevation.

If the density of stocking were uniform throughout, the correspondence of the volume, height, and diameter, curves would probably be still more marked.

The development of Group L_1 is almost as good as the larch attains in this country—the average height growth of the best trees being 2 feet per year for 23 years. In fact, so rapid has been the growth of the larch in Groups L_1, L_2, L_3, and L_4 that only a tree here and there out of the other conifers which formed three-quarters of the original crop has survived. The variations in the number of survivors in these groups are probably due only to accidental causes.

In Groups L_5 and L_6, however, a marked change is to be noticed in the crop. The larch there has made comparatively poor growth, and although still the dominant tree, has not succeeded in completely suppressing the other species. Hence it comes about that in Group L_5 there are present 340 other conifers per acre and in L_6 460 per acre. It will be noticed that in every case the spruce is present in the greatest numbers.

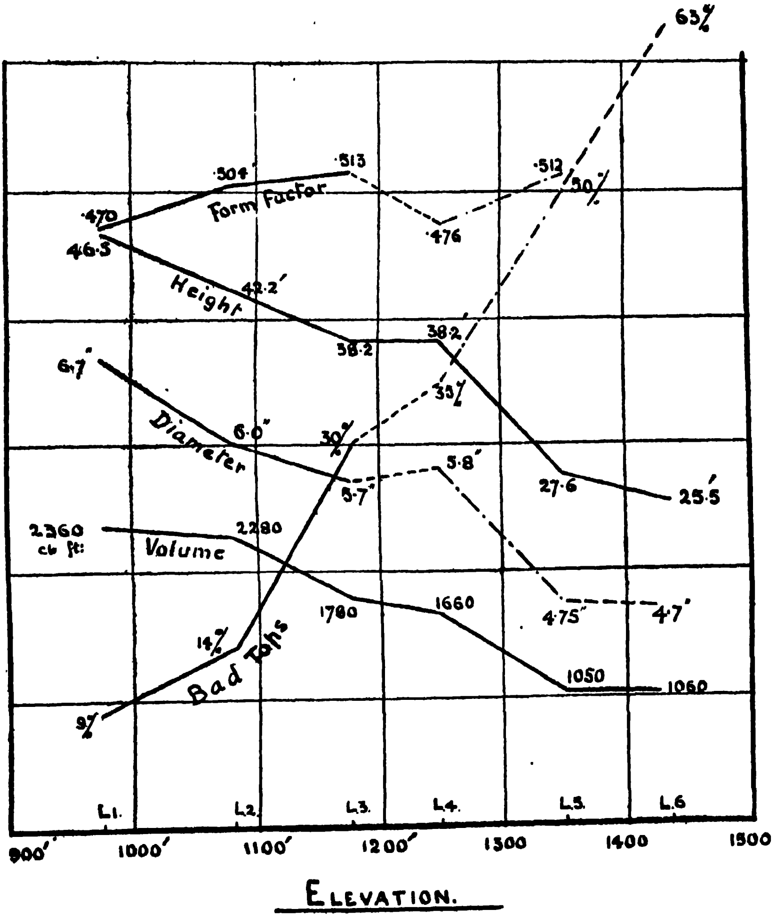


DIAGRAM SHOWING THE DEVELOPMENT OF THE LARCH SAMPLE PLOTS L_1 TO L_6.

Effect of Wind.

In addition, however, to what may be termed the diminishing vegetative activity of the larch at the higher elevations, there is another factor which has probably played an even greater part in accounting for the survival of the other conifers—*viz.*, the wind. In order to obtain some figures relative to the increasing damage due to wind at high elevations even in what appear to be perfectly sheltered localities a count was made of the number of damaged larch tops in each group, with the following results:—

Group.	Total Number of Trees.	Condition of Tops.				Total per cent. of bad Tops.	Remarks.
		Double Leaders.		Permanently deflected.			
		Number.	Per cent.	Number.	Per cent.		
L_1	168	5	3	10	6	9	
L_2	116	1	1	15	13	14	
L_3	158	19	13	25	17	30	
L_4	137	12	10	31	25	35	
L_5	119	17	14	43	36	50	Stems leaning slightly away from direction of wind.
L_6	147	23	16	69	47	63	
IV†	74	44*	60	—	—	60	Exposed situation, but with spruce shelter-belt. Elevation 1,460 ft.

* Double or triple leaders. † Referred to later, see p. 19.

The total percentage of bad tops has been represented graphically as a function of the elevation in the diagram on p. 17.

The trees with double tops may of course develop into good timber trees, but those in which the crown has taken a permanent set owing to exposure to wind seldom recover sufficiently to grow into large trees.

The fact that in Groups L_5 and L_6 50–60 per cent. of the present crop is damaged at an age of 20 years indicates that it is impossible to raise a pure crop of larch at such elevations and under such conditions. The upper limit for pure larch appears to be between Groups L_4 and L_5, *i.e.* about 1,300 feet, on such a slope.

Future Development of Sample Groups.

As a guide to the future development of these groups, older trees were felled in another wood known as Cefn Craig. The conditions as regards soil and exposure are similar to those in Cwm Golog, but the crop is very thin on the ground. The first tree (8 L) growing in a very thin wood, elevation 1,160 feet, was 51 years of age with a total height of 70 feet 4 inches, a volume of 20·5 cubic feet and a diameter at breast height of 10·4 inches. The form factor was 0·494.

The second tree, 40 years old, elevation 1,400 feet, had the following dimensions (Tree 11 L):

$v = 6{\cdot}97$ cubic feet. $h = 44{\cdot}3$ feet. $d = 7{\cdot}25$ inches. $f = {\cdot}474$.

It was growing under similar canopy conditions to the first and was the best tree which could be found at the elevation. About 50 per cent. of its fellow trees had damaged leaders.

The third tree (4 L) was one of the best trees of what was formerly a mixed crop of larch and Scotch pine growing at 1,460 feet elevation under exposed conditions. A sample area (Group IV.) was laid out here but was not worth the trouble of measuring. Tree 4 L was the best tree in the area, and at 54 years of age had the following dimensions:

$v = 6{\cdot}96$ cubic feet. $h = 42{\cdot}2$ feet. $d = 7{\cdot}8$ inches. $f = 0{\cdot}500$

The group lay in a section 60 yards by 150 yards with two-chain shelter belts of spruce on three sides. The shelter belts had apparently been introduced some years after the plantation was formed. On the sample area (0·225 acre) there were 330 larch trees per acre, of which 60 per cent. had either two or more leaders, leaving, say, 100 sound trees per acre averaging 40 feet in height. The few Scotch pines present were wretched specimens.

As with the Groups L_1 to L_6 in Cwm Golog, the conclusion is reached that above 1,300 feet elevation larch should not be planted pure in masses. In small areas protected by spruce shelter belts it grows quickly enough to form a payable crop above this elevation, but in any extensive planting scheme it could play only a minor part.

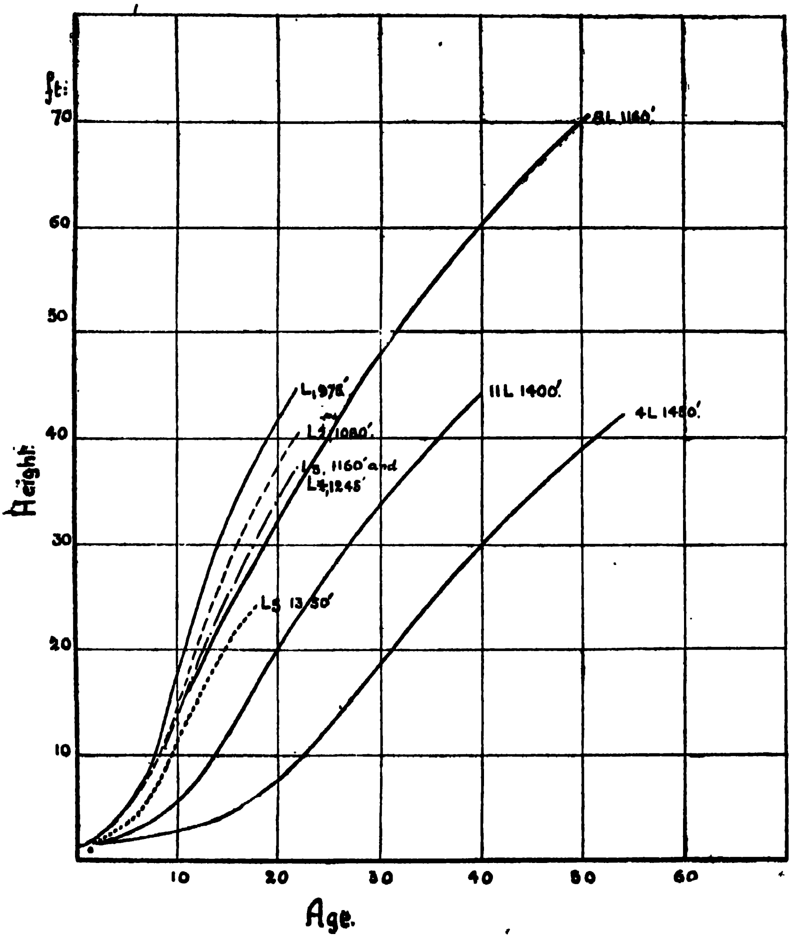
The height-growth curves of these three trees, together with the sample trees felled in Groups L_1 to L_5, are shown on p. 20.

From this diagram it will be seen that the sample trees of L_1 to L_4 all show a better height-growth than that of tree 8 L, which reached a height of 70 feet in 51 years, and the probability is that, apart from accidents, they will attain this height under proper treatment. Tree L_5 lies between the best two of the older trees felled but shows a slight tendency to fall off in growth.

The Larch on Exposed Slopes.

For the determination of the growth of larch on southern and western slopes there were present in this district one large wood known as Cefn Golog lying between 1,250 feet and 1,530 feet elevation with southern aspect, and several smaller woods lying at various elevations of from 1,250 feet to 1,400 feet with south to west aspects. Cefn Golog is practically a continuation of Cwm Golog wood with a mixture of the same species.

No groups were laid out or sample trees felled on these slopes. The preliminary inspection showed that it is only in the bottom of valleys on the south side of Kerry Hill that a pure crop of larch is at all successful at elevations up to 1,250 feet. For instance, between the elevations of 1,300 and 1,350 feet in Cefn Golog wood, 75 per cent. of the 23-year larch had damaged leaders. At 1,500 feet the tree hardly grows higher than a large bush. Descending the hill the growth gradually improves as the shelter becomes better. The rate of growth is wholly dependent on the amount of shelter available. In a word, the larch should only be planted on these slopes under exceptional conditions.



HEIGHT-GROWTH CURVES OF SAMPLE LARCH TREES GROWN AT VARIOUS ELEVATIONS.

Summary.

There is no doubt that if the damage from wind can be eliminated, larch grows rapidly enough, even above the elevation of Group L_6, to form a good crop, but taking into consideration the improbability of getting even half a fully stocked crop on the ground at 60 years, it is considered that larch becomes an exceedingly risky tree to grow above an elevation of about 1,300 feet in this district, even under conditions of exceptional shelter such as are obtained on steep northern and eastern slopes.

B. **Scotch Pine.**

As far as could be ascertained from the existing woods, Scotch pine does not appear to thrive well in this neighbourhood. This is perhaps due to the high rainfall generally and also in the higher parts to wind and snow-break.

This species has not been planted pure extensively, though it is present to a considerable extent in mixture with larch and other species in woods known as Block wood, Nant-y-Rhynau, Cefn and Cwm Golog and in Cefn and Cwm Vron. The pure plantations are at high elevations, and it was found impossible to get a series of groups to investigate the effect of elevation on this species.

The preliminary inspection showed that there is great difficulty in raising a dense crop of pure pine at altitudes of 1,400 feet and over. So much was this the case that only one group was found that was considered worthy of detailed examination. This was a 54 year old plantation, in Block Wood, standing at an elevation of 1,460 feet in a semi-exposed position (adjacent to Groups IV. and III.). The details are as follows:—

GROUP II. SCOTCH PINE.

Area, 0·225 acre. *Elevation,* 1,460 feet. *Age,* 54 years.

Slope gentle towards south, situation exposed. Soil, 6 inches peat overlying yellow loam (sample 2).

Ground covered with coarse grass.

Dominant trees per acre (of mean diameter 7·2 in.)	470
Minor trees per acre (of mean diameter 5·6 in.) ...	100
Total	570

Sample tree: h=43 feet. d=7·5 inches.
v=6·6 cub. ft. f=0·488.

Volume of Dominant Crop per acre $= \frac{30{\cdot}91}{0{\cdot}225} \times 43{\cdot}75 \times 0{\cdot}488 = 2{,}930$ cub. ft. approx.

Volume of Minor Crop per acre = 325 cub. ft. approx.

There were standing on this sample plot 470 dominant trees per acre with a total volume, including bark, of 2,930 cubic feet, and 100 minor trees with approximate volume of 325 cubic feet. Reduced to quarter girth volume without bark the approximate volume becomes 2,000 cubic feet, a volume which at 54 years is far from encouraging. Nor is the future of this plantation good. Examination of the crowns of dominant trees showed that 43 per cent. of them were damaged in such a way that the stems could not develop to the proper extent. The height-growth curve of the sample tree shows (see diagram, p. 30) that the crop has now passed the culminating point in this respect and has arrived at a time when the proper development of the crown is of the utmost importance. Plate I shows the condition of this group on its sheltered side.

At the top of Cwm Golog Wood at an elevation of 1,400 feet to 1,500 feet, on a sheltered aspect with slightly peaty soil, there is a considerable area of Scotch pine, aged about 19 years, replacing the larch woods previously referred to. These have reached a height of 12 feet to 15 feet but are already beginning to thin out and develop rough side branches owing to damage to the crowns. The condition of these Scotch pine woods bears out the general contention that this species is not at all suited in Britain for the planting of hilly land where the rain and snow-fall are heavy and the soil inclined to be peaty. At the same time, it is possible that a variety with a narrower crown would grow much better.

C. **Spruce.**

Spruce has been grown in the district at all elevations and under all conditions of exposure and aspect, chiefly in mixture with other species, but also pure in small groups up to a couple of acres in extent and in shelter belts 1 to 2 chains in width. There was, therefore, a good deal of material to work on, though much of it was of little use owing to the irregular way in which the woods had been treated.

The following is a list of the results obtained by the examination of what were considered to be the most interesting groups.

GROUP I. NEW POOL SPRUCE.

Area, 0·2 acre. *Elevation,* 1,020 feet. *Age,* 43 years.

Group lies at foot of Kerry Hill (north side) under excellent conditions as regards shelter and soil.

Trees grown in medium density. Canopy complete. Dead branches adhering strongly.

Dominant trees per acre (of mean diameter 9·0 in.)	460
Minor trees per acre (of mean diameter 6·6 in.) ...	160
Total	620

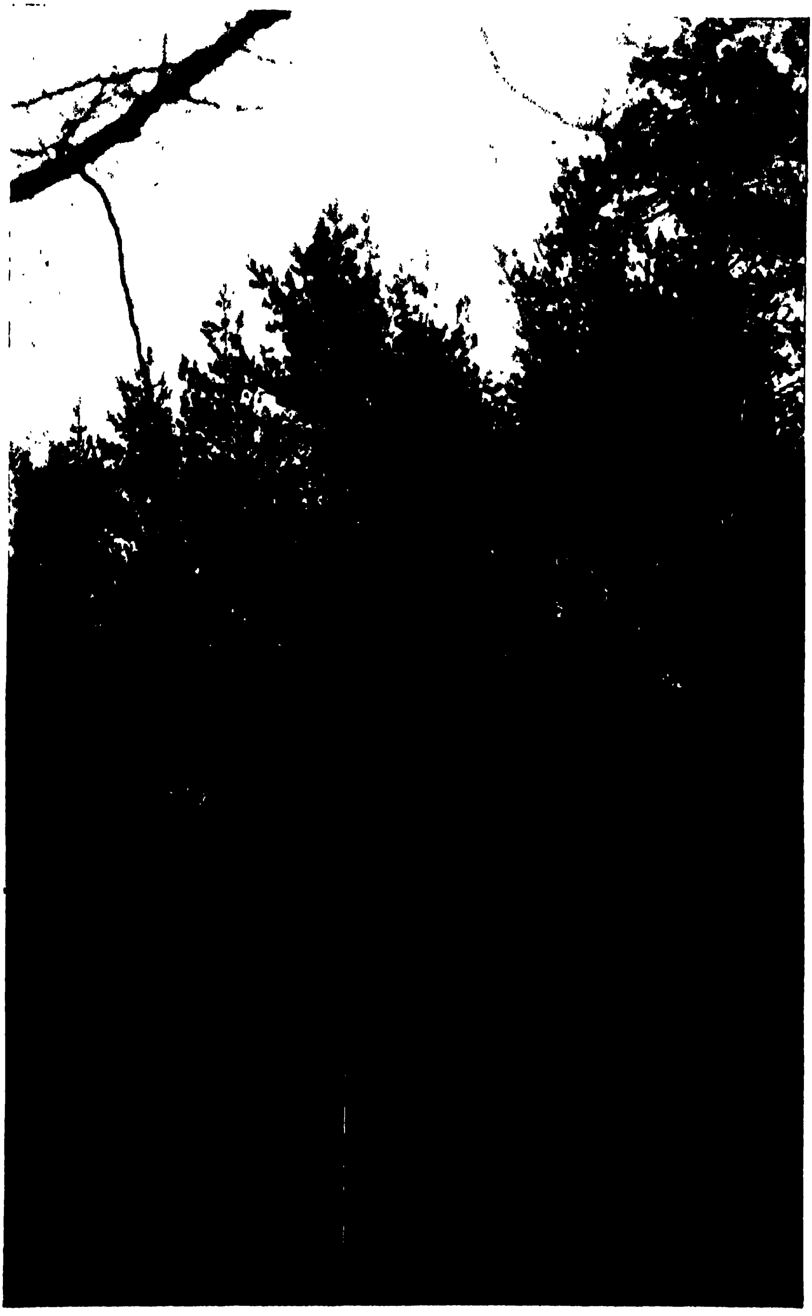


PLATE I.

GROUP II.—SCOTCH PINE.

Elevation 1,460 feet. Exposed situation. True volume 2,930 cubic feet per acre at 54 years.

[*To face p.* 22.

Sample tree: h = 52 feet. d = 8·0 inches.
v = 8·73 cubic feet. f = 0·482.

This proved a *somewhat* poor tree, having lost its leader on two occasions. The average height of the group as determined by Brandis' Hypsometer was 60 feet.

Approximate Volume per acre $= \frac{40{\cdot}1}{0{\cdot}2} \times 62 \times 0{\cdot}482 = 6{,}000$ cub. ft.

GROUP IA. NEW POOL SPRUCE.

Area, 0·125 acre. *Elevation*, 1,020 feet. *Age*, 43 years.

Adjoining Group I., but on somewhat damper soil; other conditions similar.

This group had been neglected for some years and required thinning. In addition to the dominant and minor trees there were also 105 dead trees per acre on the ground. The dead branches were still adhering but not so strongly as those in Group I.

Dominant trees per acre (mean diameter 8·2 in.) ...	600
Minor trees per acre (mean diameter 5·5 in.) ...	375
Total	975

Two sample trees were felled:—

1*A Dominant Tree* h = 63 feet. d = 7·8 inches
v = 10·53 cub. ft. f = 0·502.

1*a Minor Tree* h = 50 feet. d = 4·7 inches.
v = 3·1 cub. ft. f = 0·520.

Volume per acre, Dominant Crop $= \frac{27{\cdot}62}{0{\cdot}125} \times 64{\cdot}5 \times 0{\cdot}502 = 7{,}150$ cub.ft.

" " *Minor* " $= \frac{7{\cdot}71}{0{\cdot}125} \times 50 \times 0{\cdot}52 = 1{,}600$ cub.ft.

Total Volume per acre = 8,750 cub.ft.

GROUP III. SPRUCE: CEFN CRAIG WOOD.

Area, 0·154 acre. *Elevation*, 1,460 feet. *Age*, 43 years.

Gentle northern slope near top of Hill—semi-exposed. Adjacent to Groups II. (Scotch Pine) and IV. (Scotch Pine and Larch). Soil (sample 3) 2″—6″ peat on yellow loam.

Irregular crop growing under light canopy conditions.

Dominant trees per acre (of mean diameter 8·4 in.)	465
Minor trees per acre (of mean diameter 6·1 in.)....	130
Total	595

Sample tree: h = 52 feet. d = 8·2 inches.
v = 9·25 cub. ft. f = 0·485.

Volume of Dominant Crop per acre = $\frac{27{\cdot}88}{0{\cdot}154} \times 53{\cdot}3 \times 0{\cdot}485 = 4{,}680$ cub. ft.

GROUP V. SPRUCE SHELTER BELT, EAST OF KERRY POLE COTTAGE.

Area, 0·1 acre. *Elevation,* 1,525 feet. *Age,* 42 years.

Situated at the top of Kerry Hill. Slope slightly towards North. Full exposure to S. and S.W. winds. Soil, 4 inches peat on yellow loam (samples 5 and 6).

Grown under moderately dense canopy conditions.

Dominant trees per acre (of mean diameter 6·4 in.)	840
Minor trees per acre (of mean diameter 5·0 in.) ...	210
Total	1,050

Sample tree: h = 40·5 feet. d = 6·2 inches.
v = 4·37 cub. ft. f = 0·513.

Volume of Dominant Crop per acre = $\frac{18{\cdot}95}{0{\cdot}1} \times 41{\cdot}5 \times 0{\cdot}513 = 4{,}030$ cub. ft.

GROUP VI.

Area, 0·221 acre. *Elevation,* 1,525 feet. *Age,* 42 years.

Part of Shelter Belt in which Group V. is situated, but on the windward slope of Kerry Hill. Soil as in Group V.

Grown under moderately dense canopy conditions.

Dominant trees per acre (of mean diameter 6·1 in.)	890
Minor trees per acre (of mean diameter 4·8 in.) ...	290
Total	1,180

Sample tree: h = 40·2 feet. d = 5·8 inches.
v = 3·7 cub. ft f = 0·498.

Volume of Dominant Crop per acre = $\frac{39{\cdot}51}{0{\cdot}221} \times 41{\cdot}2 \times 0{\cdot}498 = 3{,}670$ cub. ft. approx.

GROUP VII. NANT-Y-RHYNAU WOOD.

Area, 0·2 acre. *Elevation,* about 1,400 ft. *Age,* 43 years.

Aspect.—Somewhat steep slope facing S.W. on south side of Kerry Hill. Soil somewhat shallow loam. Exposure.—About three-quarters of full.

Regular and well-grown crop of medium density. Lower branches had been stripped away.

Dominant trees per acre (of mean diameter 7·5 in.)	615
Minor trees per acre (of mean diameter 6 in.) ...	205
Total	820

Sample tree: $h=51{\cdot}25$ feet. $d=7{\cdot}1$ inches.
$v=7{\cdot}01$ cub. ft. $f=0{\cdot}498$.

Cub. ft. approx.

Volume of Dominant Crop per acre $= \frac{37{\cdot}68}{0{\cdot}2}\times 52{\cdot}5\times 0{\cdot}498 = 4{,}930$

" " *Minor* " " $= \frac{8{\cdot}11}{0{\cdot}2}\times 45\times 0{\cdot}5 = 910$

Total 5,840

GROUP IX.—CEFN GOLOG WOOD.

Area, 0·213 acre. *Elevation*, 1,530 feet. *Age*, 38 years.

On north side of Kerry Hill, but considerably exposed.

Soil (sample 9) 6–8 inches peat on yellow loam.

Grown under medium to dense canopy conditions.

Dominant trees per acre (of mean diameter 5·4 in.)	1,180
Minor trees per acre (of mean diameter 3·8 in.) ...	330
Total	1,510

Sample tree: $h=37{\cdot}5$ feet. $d=5{\cdot}4$ inches.
$v=3{\cdot}18$ cub. ft. $f=0{\cdot}534$.

Volume of Dominant Crop per acre $= \frac{40{\cdot}49}{0{\cdot}213}\times 38{\cdot}5\times 0{\cdot}534 = 3{,}900$ cub. ft. approx.

GROUP XIII.

CEFN GOLOG WOOD. *Area*, 0·218 acre. *Elevation*, 1,530 feet. *Age*, 38 years.

Adjacent to Group IX. and under similar conditions as regards soil and exposure.

Grown under medium density.

Dominant trees per acre (of mean diameter 5·8 in.)	900
Minor trees per acre (of mean diameter 4·8 in.) ...	200
Total	1100

Sample tree: $h=41{\cdot}5$ feet. $d=5{\cdot}75$ inches.
$v=4{\cdot}07$ cub. ft. $f=0{\cdot}542$.

Volume of Dominant Crop per acre $= \frac{36{\cdot}62}{0{\cdot}218}\times 41{\cdot}5\times 0{\cdot}542 = 3{,}780$ cub. ft. approx.

SUMMARY OF SPRUCE GROUPS (DOMINANT CROP).

Group.	Elevation.	Side of Kerry Hill and Aspect.	Canopy-Density.	Age.	Mean Height.	Mean Diameter.	Number of Stems per acre.	Form Factor.	True Vol. per acre.
	feet.			*years.*	*feet.*	*inches.*			*cub. ft.*
I.	1,020	N. side, N. aspect.	Medium.	43	62·00	9·0	460	0·482	6,000
IA.	1,020	,,	Dense.	43	64·50	8·2	600	0·502	7,150
III.	1,460	,,	Light.	43	53·30	8·4	465	0·485	4,680
V.	1,525	Top, N. aspect.	Medium.	42	41·50	6·4	840	0·513	4,030
VI.	1,525	Top, S. aspect.	,,	42	41·20	6·1	890	0·498	3,670
VII.	1,400	S. side, S.W. aspect.	,,	43	52·50	7·5	615	0·498	4,930
IX.	1,530	N. side, near top.	Medium to Dense.	38	38·50	5·4	1,180	0·534	3,900
XIII.	1,530	,,	Medium.	38	41·50	5·8	900	0·542	3,780

PLATE II.

GROUP XII.—CORSICAN PINE.

Elevation about 900 feet. Sheltered situation. True volume 6,300 cubic feet per acre at 40 years.

[*To face p.* 26.

It is not proposed to discuss these results at this stage; this is done fully later, but it may be pointed out here that Groups I. and IA occupy situations which approach the best obtainable in the district, V., VI., and IX. approach the worst, while III. and VII. may be described as growing under poor to moderate conditions. The particulars relating to the growth of the various groups of spruce are summarised in the table on p. 26.

D. **Miscellaneous Species and Mixtures of Species.**

1. *Corsican Pine.*

Corsican Pine has been grown quite extensively in mixture with other species at various elevations. In many cases it does well and does not suffer from wind and snow to the same extent as Scotch Pine at similar high elevations. At the same time its growth is not always satisfactory. In wet places, especially, many of the trees die off when 12 to 15 feet high, leaving an irregular crop on the ground. Only one group was available for measurement. This stood at an elevation of 900 feet in Fronderw Wood (north side of Kerry Hill) on a steep, well-sheltered western slope. The following are details of the crop.

GROUP XII. CORSICAN PINE.

Area, 0·146 acre. *Elevation,* 900 feet. *Age,* 40 years.
Aspect, West.

Soil—loam, well drained, in excellent condition and well protected with thick layer of needles.

Dominant trees per acre (of mean diameter 10·5 in.)	445
Minor trees per acre (of mean diameter 7·7 in.) ...	110
Total	555

Crop irregular. Density of stocking, about 0·9.

Sample tree: h = 53·3 feet. d = 10·0 inches.
v = 14·34 cub. ft. f = 0·493.

The sample tree was rather higher than the main crop, which may be put at 48 feet high.

Volume of Dominant Crop per acre $= \frac{38{\cdot}92}{0{\cdot}146} \times 48 \times 0{\cdot}493 = 6{,}300$ cub. ft.

The quarter girth volume of the sample tree, without bark, was 9·3 cubic feet, which gives a total volume per acre quarter girth of 4,200 cubic feet for the dominant part of the crop.

These figures show that under favourable circumstances this species will give a very large return per acre—in the given case 105 cubic feet mean annual increment quarter girth at an age of 40 years.

The sample tree was still growing very vigorously and had made leaders of 18 to 20 inches for the last ten years. The height-growth curve is shown on page 30, and from this it will be seen that the rate of growth as yet shows little or no signs of falling off, and it would not be unreasonable to predict a height of 63 feet at 50 years of age.

It must be noted that 28 per cent. of the dominant trees and 31 per cent. of the minor trees on this group had either double tops or had received some injury to their leading shoot. The cause of this injury was not apparent, since the group was well sheltered from wind.

Plate II. illustrates the appearance of the trees in this group. Unfortunately there were no other groups old enough to be worth measuring, but this species is growing wonderfully well everywhere under favourable conditions.

2. *Douglas Fir with Larch.*

Douglas fir has been planted extensively in the sheltered valleys on the north side of Kerry Hill, generally in mixture with larch. Its growth is very rapid and at 24 years the best larch are already in danger of suppression. In situations where the larch has attained a height of 40 feet at 22 years of age, the Douglas fir is about 5 feet taller and rapidly increasing its lead.

Douglas fir could be safely planted on sheltered aspects up to 1,250 feet elevation, and on favoured spots even up to 1,300 feet, but its use is sharply restricted. On wet soils, even at the bottom of valleys, it shows a tendency to be thrown by wind even before its fragile leader has been broken. The height-growth curve given in the diagram, p. 30, was taken from a blown tree on wet soil, and is hardly a fair criterion of the rate of growth.

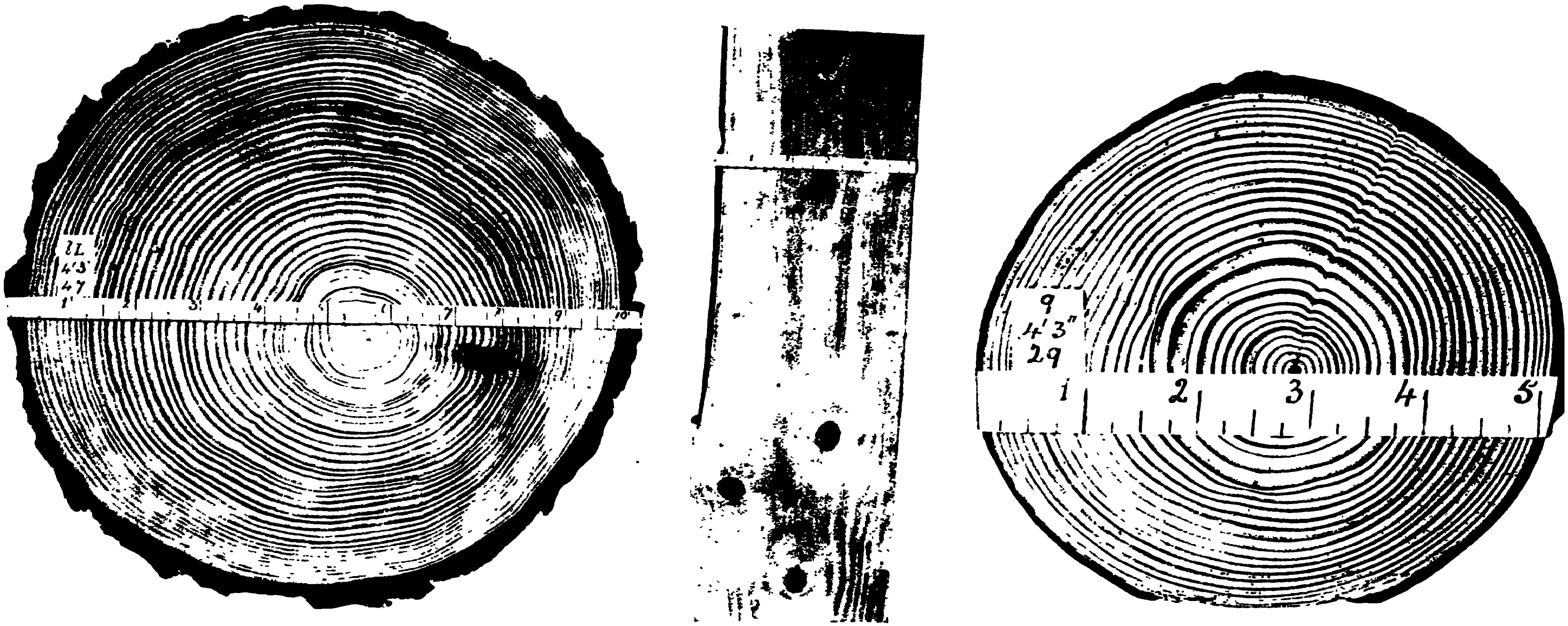
3. *Douglas Fir with Abies Grandis and Larch.*

A considerable area in Llwyn-y-rhŵd wood has been planted with a mixture of these species. The locality is very well sheltered at 900 feet elevation and the soil is deep though inclined to be wet. *Abies grandis* has shown remarkable growth and at 24 years of age averages 60 feet in height. A tree, which had been broken off, had the following dimensions: $v = 10{\cdot}5$ cubic feet quarter girth in first 30 feet of bole; $h = 59$ feet 3 inches; $d = 10{\cdot}8$ inches.

The Douglas fir average 50 feet to 55 feet high, while the larch are completely overshadowed.

4. *Larch, Scotch Pine, and Spruce.*

Very large areas have been planted with these three species in about equal proportions or with a larger proportion of larch. The result is not satisfactory. On the lower ground larch suppresses the other two species, while on the upper the spruce is the most vigorous tree and develops large side branches which are not killed off by the less vigorous Scotch pine and larch. The poor quality of the resulting spruce timber is shown in Fig. B, Plate III.



A. LARCH. Tree 8L.

B. SPRUCE.

C. SPRUCE. Tree 9.

PLATE III.
TIMBER SECTIONS.

[*To face p.* 28.

5. ***Thuya gigantea, Chamaecyparis Lawsoniana, Cupressus macrocarpa, Pinus ponderosa, Picea sitchensis, and other exotics.***—These have been planted singly or in small groups here and there on the lower ground. They are very interesting as showing the rates of growth of the various species, but, from the way they have been grown, are not of sufficient economic interest for detailed description here.

E. The Relative Rates of Height Growth of the Different Species.

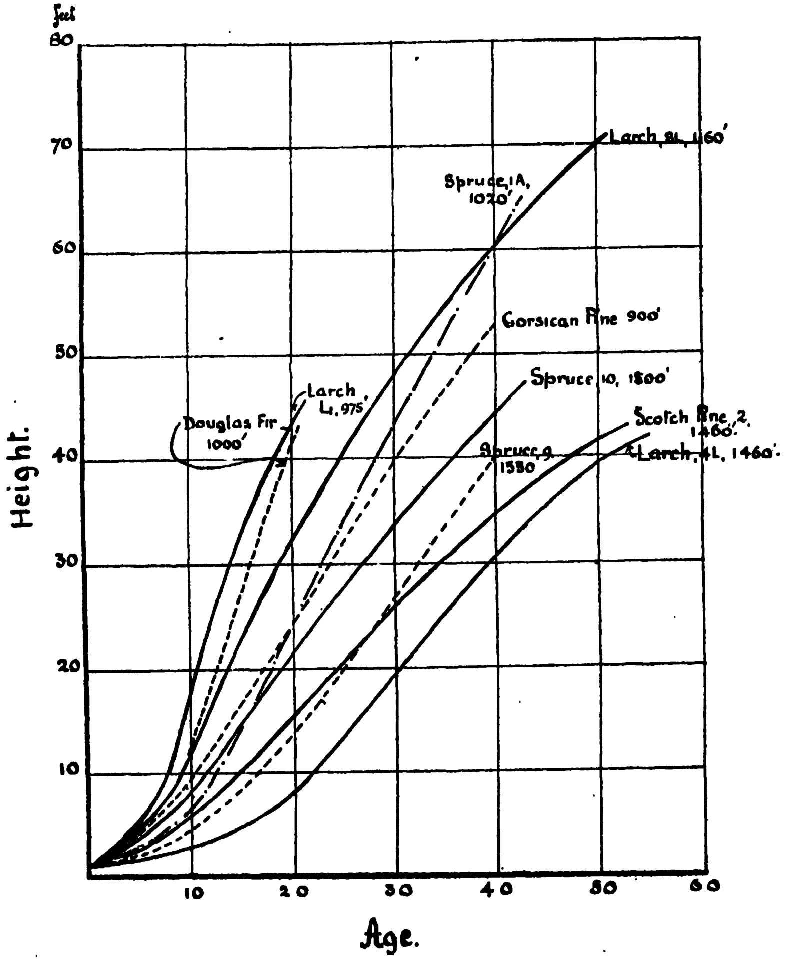
On p. 30 some of the height-growth curves have been collected together in order to illustrate the relative rates of growth of the various species dealt with at different elevations.

The curves show that of the three chief species—larch, spruce, and Scotch pine—the first named starts away fastest under good conditions, and maintains its lead until at least the 40th year, when the spruce begins to overtake it. Under poor conditions, however (*e.g.*, tree 4L, 1,460 feet elevation), the larch is very slow in starting. Probably the Scotch pine grows best in early youth in such circumstances, though the curves do not fully indicate this, owing to the fact that only two sample trees were felled. It is in its subsequent development, after the canopy has been formed, that this species is so disappointing. The spruce is in all cases a slow starter, but makes up for this by its steady growth afterwards. From this it appears that an attempt to estimate the value of the locality for spruce from existing woods is likely to prove useless unless the woods are at least 30–40 years old. It is in this connection that a graphic representation of the height-growth is most useful.

In the following table the rates of growth are arranged according to elevation, and an attempt is made to predict, from the height-growth curve, the probable height at 60 years.

Tree (Group).	Elevation.	Exposure and Aspect.	Age when felled.	Height when felled.		Estimated height at 60 years.
	ft.		yrs.	ft.	in.	ft.
Larch, L_1	975	N. Sheltered	22	44	6	85 ?
Spruce, 1A	1020	"	43	63	0	86
Larch, 8L	1160	"	51	70	4	77
Larch, 11L	1400	"	40	44	4	54
Spruce, VII	1400	S.W. Exposed	42	51	3	67
Spruce, III ...	1460	Semi-exposed Top of hill	42	52	0	67
Scotch Pine, II			53	43	0	46
Larch, 4L			54	42	2	45
Spruce, 10...	1510	Semi-exposed. N.	45	47	0	58
Spruce, V & VI ...	1525	Full exposure Top of Hill	41	40	3	55
Spruce, IX	1530	Semi-exposed	38	38	0	65

The last column of the table, although it cannot claim to be very accurate, indicates the superior growth of spruce in all except the very best situations. It must be further remembered that the spruces represent in all cases the mean tree of a group, whereas the larches were selected (at higher elevations) from among the best (*i.e.*, undamaged) stems at the given elevations.



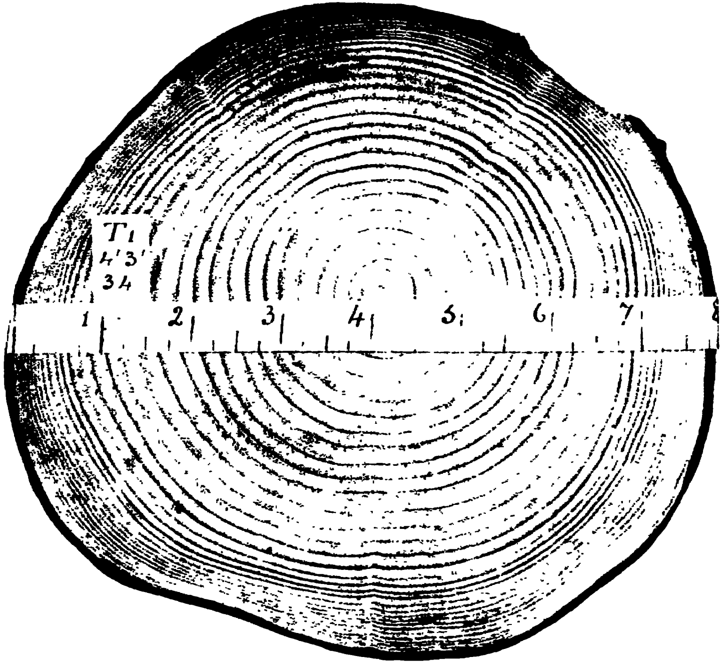
HEIGHT-GROWTH CURVES OF SOME OF THE SAMPLE TREES FELLED.

It may be said that on all aspects the spruce should here attain a height of at least 60 ft. in 60 years at an elevation of 1,500 ft.

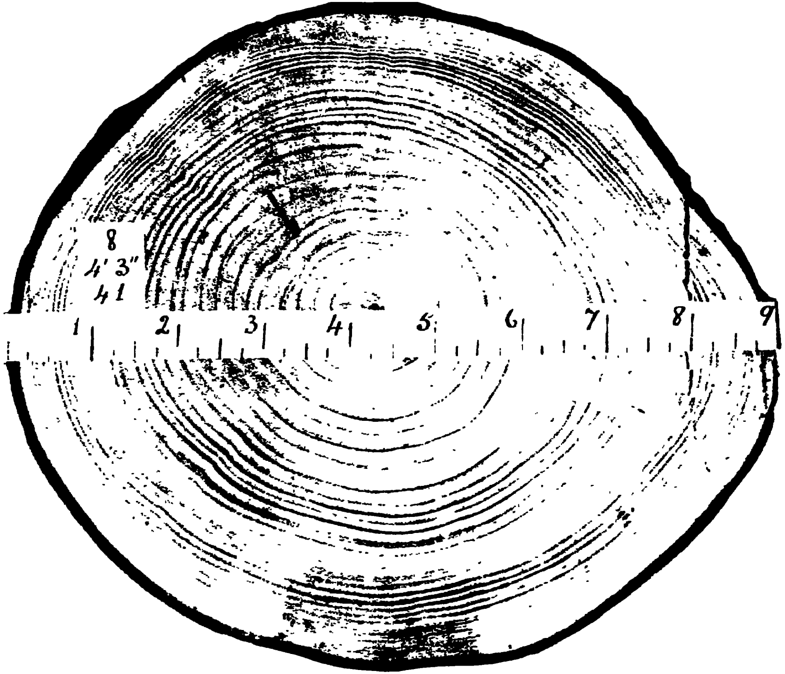
F. Quality of the Timber.

A few of the sections taken from the sample trees felled have been reproduced to show the quality of the timber. Some of these sections bear labels, on which the top number is the number of the sample tree, the second the height of the section from the ground, and the bottom the number of annual rings in the section.

Larch.—The larch timber generally is of good quality. The



SPRUCE. TREE NO. 1.



SPRUCE. TREE NO. 8.

PLATE IV.

TIMBER SECTIONS.

[To face p. 30.

section illustrated in Plate III. (Tree No. 8L) was a particularly good specimen, with an average of about 10 rings per inch of radius and a large proportion of heartwood.

Spruce.—The quality of the spruce timber varies very greatly according to the method of growth. Of the specimens illustrated, No. 9 (Plate III.), was grown under uniformly dense canopy conditions, while Nos. 1 and 8 (Plate IV.), and 3 (Plate V.), varied from moderate canopy conditions in youth to denser conditions later in life. According to Janka,* regularity in the width of the annual rings and a large proportion of summer to spring wood are the chief factors governing the quality of spruce timber, assuming the absence of knots. The narrower the rings the better the timber as a rule. Judged by this standard, No. 9 (1,530 ft. elevation) is a good specimen of spruce timber, while the remaining specimens, with the exception of No. 3 (1,460 feet elevation) (Plate V.), are inferior owing to irregular treatment of the crop. If grown properly, there is no reason why spruce timber of good quality should not be produced at all elevations in the district.

The longitudinal section in Plate III. represents the characteristically coarse and knotty character of spruce timber when grown in mixture with larch and Scotch pine.

The spruce is attacked by heart-rot, especially on dry soils, at an advanced age, but appears to be quite sound up to 70 years of age.

Scotch Pine.—The Scotch pine timber grown on the estate is of poor quality, and up to 54 years of age is very little superior to spruce. No. 2, Plate V., represents the breast-height section from the sample tree of Group II. (54 years old, 1,460 ft. elevation). The tree was just beginning to form heartwood when felled.

Douglas Fir has not been grown under dense conditions, and hence the timber is knotty and broad-ringed. In spite of the wide rings, however, the timber is hard and strong. The section illustrated, Plate VI., was taken from an unknown tree, and apparently at some distance up the stem. The rings are remarkably wide and even, and after thorough seasoning the wood appears to be of excellent quality, with a good proportion of heartwood.

Corsican Pine.—The wood, as illustrated by No. 12, Plate V., indicates, that if properly treated, good Corsican pine timber may be grown in the district. The wood is inclined to be coarse, and at 40 years of age the sample tree had just begun to form heartwood.

Austrian Pine.—The section in Plate VI. was grown in a somewhat open position in an avenue. The timber is broad-ringed and coarse, and splits readily.

---

* "Elastizität und Festigkeit der österreischen Bauhölzer."—*Mitteilungen aus dem Forstlichen Versuchswesen Österreichs.* Heft XXXV.

III.—UTILISATION OF THE DATA FOR A SURVEY.

A. **Method of Arriving at a Basis for a Survey.**

General Considerations.

Any survey of land for forestry purposes must rest fundamentally on financial considerations. It is admitted that afforestation might be justifiable on economic grounds other than direct remunerativeness, but even in such cases financial considerations must indicate the land to be afforested. The first question to be asked before planting a piece of land is, "Will it pay?" In answer to this much loose talk on afforestation has been indulged in from time to time, but the evidence adduced in support of opinions has really been of very little value, since, as a rule, it has not been supported by sufficient figures to form any accurate generalisation on the subject.

To give a satisfactory reply, the following data are necessary:—

(*a*) The minimum rate of interest which invested capital is desired to yield.

(*b*) The cost of forming the plantation.

(*c*) The returns in cubic feet of timber per acre from period to period.

(*d*) The nett price of timber per cubic foot at each period.

(*e*) The cost of upkeep, management, &c., per acre per year throughout the whole rotation.

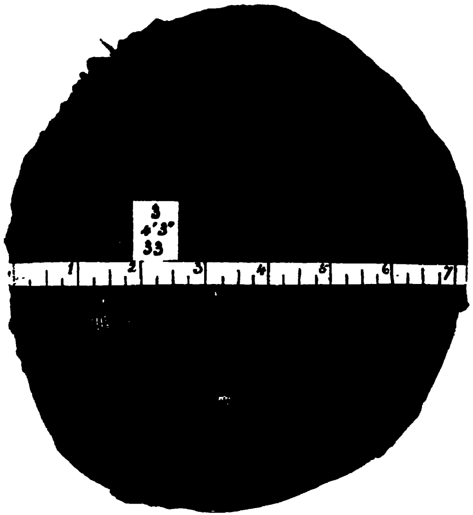
If these data are given, the soil rental, and hence the value of the land for forestry purposes, can be obtained by a simple calculation.

Of these five sets of data, (*a*), (*b*), (*c*), and (*e*) are either known, or are capable of experimental determination within comparatively accurate limits.

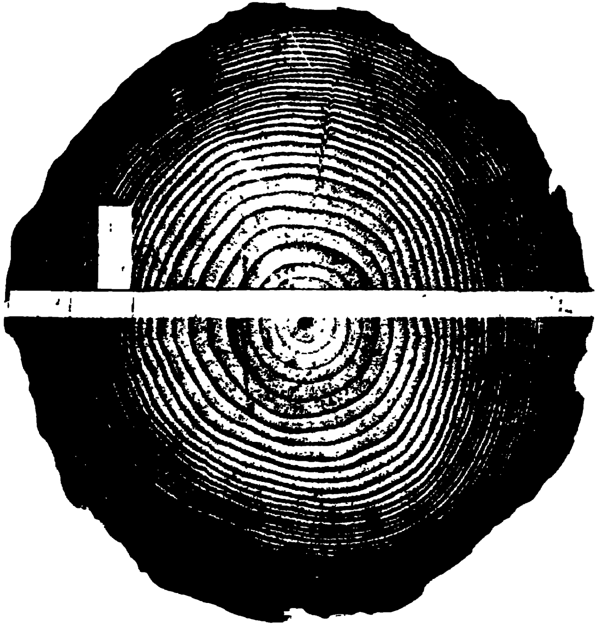
(*a*) With regard to the rate of interest, the security offered by forests is considered by most authorities to be very good. In the present calculation 3 per cent. is taken. It is approximately the rate at which the State could borrow money for afforestation purposes.

(*b*) The cost of planting spruce should not exceed £5 per acre, including fencing and drainage, if the work is done on a large scale. The actual cost can best be ascertained by experimental afforestation on a large scale.

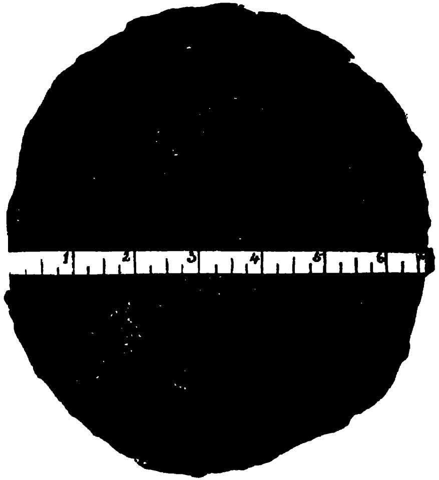
(*c*) The returns per acre from period to period can be obtained only from yield tables.



SPRUCE. TREE NO. 3.



CORSICAN PINE. TREE NO. 12.



SCOTCH PINE. TREE NO 2.

PLATE V.

TIMBER SECTIONS.

[*To face p.* 32.

As no reliable tables have been compiled for Britain, this is probably the greatest difficulty at the moment to be faced in making a valuation.

(*d*) The price which timber will bring, say, 60 years hence is very problematical. At present it is known that prices show a tendency to rise, and, as far as can be judged from the available timber supplies, will continue to rise to figures considerably higher than those at which they now stand. The safest method is therefore to take present prices.

It is assumed that the following prices would be obtained for spruce timber if grown on a large scale.*

Size of Tree, cub. ft.	Price per cub. ft. (True Volume).
Less than 0·5	—
0·5 — 1	1*d.*
1 — 5	2*d.*
5 – 10	2½*d.*
10 — 20	3*d.*
20 – 40	3½*d.*
over 40	4*d.*

(*e*) The cost of upkeep and management is assumed to be 4*s.* per acre per year.

From the foregoing it will be seen that calculations as to the probable return from forestry are beset with many difficulties even in the most favourable circumstances. There are many influences which may so modify the returns as considerably to reduce the value of the calculations. At the same time, there is no other method available. The man who recommends a piece of planting

---

* Schwappach (*Wachstum und Ertrag normaler Fichtenbestände in Preussen*, p. 108) uses approximately the following prices in calculations of a similar nature. The conditions in Britain and in Prussia are, of course, not similar, but the table gives some indication of the prices which spruce timber will bring under good conditions as to utilisation.

Size of Tree, cub. ft.	Nett price in pence per cub. ft. (True Volume).
0·35	2
0·75	2¼
1·0	2½
2·0	3
3·5	3½
7·0	4¼
10·0	4¾
14·0	5¼
20·0	5½
30·0	6
70·0	7
85·0	7½

because it will pay consciously or unconsciously [illegible] estimate of the probable volume and then of the probable value of the crop.

Use of Yield Tables.

In the preceding pages material has been collected which may be considered fairly representative of woods from which evidence as to the rate of growth of timber in hilly districts will have to be drawn. The important point is how best to utilise these data for the valuation of neighbouring land for forestry purposes, and hence to lay down the method of procedure for a local forestry survey.

The crux of the whole matter is to estimate with reasonable precision the volume which the various woods will develop by the end of the rotation. If yield tables were available for the various species, this would be a comparatively easy matter, since a determination of the factors yielding the existing volume (total basal area per acre, height, and form factor) enables a wood to be placed in its quality class, and if the rotation be well advanced an accurate estimate of the probable volume may be made.

It would considerably simplify matters if the survey of a given district could be made with a single species as the basis, *i.e.*, if the land could be mapped into given classes for the one species, which could be made equivalent to other classes for other species if so desired. It is believed that in the present instance this can be done by using the spruce for the purpose.

It has been shown that above 1,300 ft. on the best sheltered aspects, and on practically all exposed sites, the larch is too uncertain a crop to be of any use for valuation purposes. The Scotch pine nowhere grows well, and is equally useless. The spruce is apparently the best indicator, and the necessity arises of estimating the development of the 43-year-old woods measured.

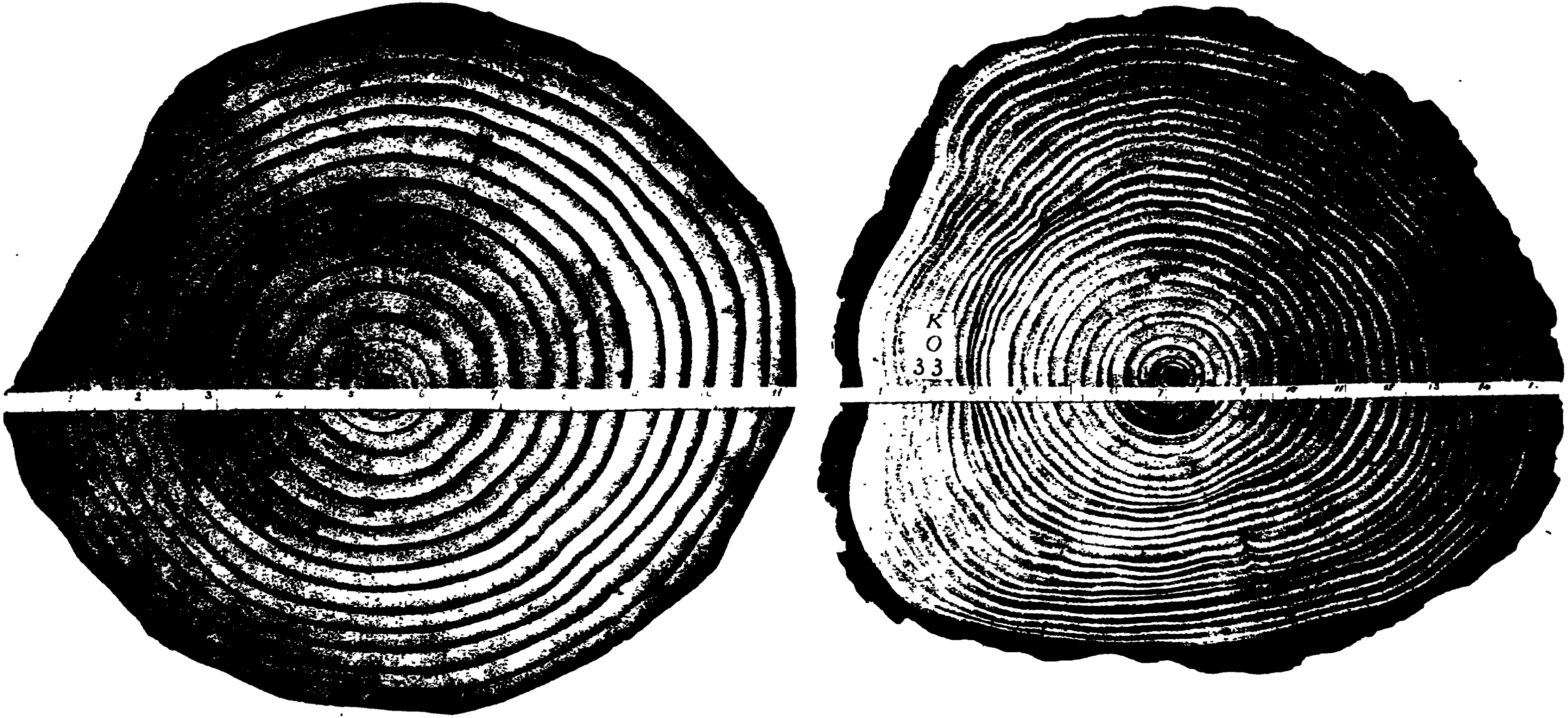
After examining several sets of Continental tables, it was resolved to test the applicability of those prepared by Schiffel for Austrian conditions.* These are of peculiar use for British woods, since three separate canopy classes are recognised—dense, medium and light—whereas the usual tables relate only to dense canopy conditions, and are therefore of only very exceptional use for comparative purposes in Britain.

Before making any comparisons, some explanation of the sylvicultural properties of the spruce and of the nature of Schiffel's tables is desirable.

An examination of the tables shows that the factors on which the volume is calculated may vary considerably within the limits of each quality class, according to the density of the canopy

---

* Wuchsgesetze Normaler Fichtenbestände. *Mitt. aus dem Forst. Versuchsw. Österreichs.* Heft. XXIX.



Douglas Fir.

Austrian Pine.

PLATE VI.

Timber Sections.

[*To face p.* 34.

under which the crop has been grown. The following table, showing the limits of variation for woods 43 years old, has been compiled from Schiffel's figures :—

Quality Class.	h.	d.	N	f.	V
	feet.	inches.	Number of trees per acre.		cub. feet.
(Best) XI.	59 to 74	7·5 to 10·7	600 to 360	0·500 to 0·448	5,400 to 6,900
X.	52 to 66	6·5 to 9·5	700 to 430	0·516 to 0·460	5,100 to 5,900
IX.	46 to 59	5·7 to 8·2	850 to 500	0·529 to 0.470	3,600 to 4,800
VIII.	39 to 52	4·7 to 7·0	1050 to 640	0·546 to 0·490	2,700 to 3,900
VII.	33 to 44	4·0 to 5·9	1350 to 775	0·547 to 0·504	2,150 to 3,350

From this it appears that the values of the different factors may overlap to a considerable extent. For instance, a crop of mean height 52 ft. at 43 years, though most likely to fall nearest quality Class IX., might conceivably fall nearest Class X. or VIII. It is therefore necessary, in making an estimate of the quality of the locality in which a crop is growing, to consider all the factors together.

Schiffel indicates in his introduction to the tables a number of properties of the spruce which are not very generally recognised in this country. The chief of these is that spruce shows a greater height-growth increment in open, than in dense, crops.

With regard to the use of his tables, the following points should be noted :—

(*a*) On soils of the same quality, with crops of the same age, the height and diameter are greatest, but the form factor is smallest, in the case of the least canopy density.

(*b*) The total basal area and total volume per acre are least in the case of light canopy conditions until the crops are 100 years of age, when the three canopy classes merge into one.

(*c*) The number of trees per acre is least in the case of the thin canopy class, and greatest in the case of the dense canopy class.

For each canopy class nine quality classes are prepared, of which III. is the worst, and XI. the best. The number indicating the quality class is arranged for convenience as regards the metric system, since it is the number, in hundreds, of cubic metres which a hectare should carry at the age of 100 years. Thus a spruce crop on soil of quality X. should yield 1,000 f.m. per ha. (or roughly 14,300 cub. ft. per acre) at 100 years of age.

Schiffel gives directions as to the method of estimating the quality of the locality when a crop of spruce is standing on the ground. It is obviously not sufficient simply to take the height and age and then observe the class most nearly corresponding in the tables, since such a method takes no account of the density in which the crop has been grown, and it has been pointed out above (*a*) that the spruce grows more quickly in open than in close stand. Age, height, mean diameter, and number of trees per unit area are at least necessary for proper classification.

The ratio $\frac{\text{number of trees per unit area}}{\text{mean diameter}}$ gives a useful index as to the density in which the crop has been grown, and is called by Schiffel the crop characteristic (*Bestandescharakteristik*). By the method of stem analysis a general view of the height development of the crop can be obtained, which is of interest in comparing the height-growth of the crop under consideration with the ideal given in the Yield Tables.

Comparison of Sample Plots with Schiffel's Tables.

It will now be shown to what extent the measurements made in the sample plots agree with Schiffel's Tables.

The following abbreviations are used throughout for the sake of convenience :—

H = mean height of crop, D = mean diameter, N = number of stems per acre, f = form factor, A = total basal area, V = total true volume per acre, C = crop characteristic = N/D, Q = quality class.

GROUP I.—1,020 *ft.* *Elevation.*

Quality Class.	Canopy Density.	Age.	*H.*	*D.*	*N.*	*f.*	*A.*	*V.*	*C.*
		Years.	*Ft.*	*In.*			*Sq. ft.*	*Cub. ft.*	
Schiffel's XI.	Medium	40	61·0	8·1	518	0·482	185	5,490	64
Group I. ...	,,	43	62·0	9·0	460	0·482	200	6,000	51
Schiffel's XI.	,,	45	68·9	9·3	429	0·474	202	6,620	46

As will be seen in the comparative table above, the height growth of this crop for medium canopy conditions lies between qualities XI. and X. of Schiffel's Tables, but rather nearer the former. The number of trees per acre, the form factor, and the crop characteristic correspond very nearly with those of Class XI., but since the diameter is slightly too high, the total basal area, and consequently the volume, are also too high.

The general results, however, are very similar.

GROUP IA. 1,020 *ft. Elevation.*

Quality Class.	Canopy Density.	Age.	*H.*	*D*	*N.*	*f.*	*A.*	*V.*	*C.*
		Years.	*Ft.*	*In.*			*Sq. ft.*	*Cub. ft.*	
Schiffel's XI.	Dense	40	58·0	7·3	664	0·508	193	5,720	91
Group IA. ...	,,	43	64·5	8·2	600	0·502	220	7,150	73
Schiffel's XI.	,,	45	65·5	8·4	542	0·498	209	6 830	65

The height growth of this group has been slightly better than the mean of the best quality class (XI.), which at 43 years of age should indicate 62·5 ft.; consequently it is found also that the mean diameter, although approaching very closely to the tables, is a little too large. The number of trees per acre is also slightly too great. The form factor shows very close correspondence. Consequent on the larger diameter and greater number of trees, the total basal area is approximately 10 per cent. larger. For the same reason the volume is larger. The crop characteristic corresponds well with those of the tables.

GROUP III.—1,460 *ft. Elevation.*

Quality Class.	Canopy Density.	Age.	*H.*	*D.*	*N.*	*f.*	*A.*	*V.*	*C.*
		Years.	*Ft.*	*In.*			*Sq. ft.*	*Cub. ft.*	
Schiffel's IX.	Light.	40	50·5	7·0	559	0·473	149	3,550	80
Group III. ...	,,	43	53·3	8·4	465	0·485	181	4,680	55
Schiffel's IX.	,,	45	58·4	8·2	454	0·465	167	4,500	55

Group III. had been treated in an irregular way. This is shown by the relative numbers of trees falling into each diameter class. The result is that, although there were standing 595 trees per acre in all, no less than 130 of these belonged to the minor part of the crop, notwithstanding that the whole had been grown in very open stand. The height-growth is rather too small to fall in the mean of Schiffel's Class IX. light canopy, but approaches more nearly to it than to Class VIII.

The number of dominant trees (465) per acre is too low, and consequently the diameter is too large, and the crop characteristic too low.

The sample tree was felled from the densest part, so as to disturb the crop as little as possible, and consequently the form factor is high. The total basal area, and hence the volume, are also considerably too large.

GROUPS V. AND VI.—1,525 *ft. Elevation.*

Quality Class.	Canopy Density.	Age.	*H*	*D*	*N*	*f*	*A*	*V*	*C*
		Years	*Ft.*	*In.*			*Sq. ft.*	*Cub. ft.*	
Schiffel VIII.	Medium	40	40·3	5·1	939	0·525	133	2,830	184
Group V. ..	,,	42	41·5	6·4	840	0·513	189	4,030	131
Group VI. ...	,,	42	41·2	6·1	890	0·498	180	3,670	146
Schiffel VIII.	,,	45	47·6	6·25	735	0·509	157	3,660	118

As regards height-growth, Groups V. and VI. lie somewhat below Schiffel's Quality Class VIII. with regard to canopy density. There is a considerable divergence in the values of the diameters, especially in Group V., where the value is much too large. The result is that since the number of trees per acre is approximately correct, the volume is much too large.

GROUP VII.—1,400 *ft. Elevation.*

Quality Class.	Canopy Density.	Age	*H*	*D*	*N*	*f*	*A*	*V*	*C*
		Years.	*Ft.*	*In.*			*Sq. ft.*	*Cub. ft.*	
Schiffel IX.	Medium	40	47·9	6·26	720	0·499	153	3,670	115
Group VII.	,,	43	52·5	7·5	615	0·498	189	4,930	82
Schiffel IX.	,,	45	55	7·3	590	0·491	172	4,620	81

The height-growth of the group corresponds very nearly with Quality Class IX. of Schiffel's medium canopy density, as do the number of trees per acre and the form factor. The diameter is again considerably too large, with the result that the crop characteristic is too low and the volume too large.

GROUP IX.—1,530 *ft. Elevation.*

Quality Class.	Canopy Density.	Age.	*H.*	*D.*	*N.*	*f.*	*A.*	*V.*	*C*
		Years.	*Ft.*	*In.*			*Sq. ft.*	*Cub. ft.*	
Schiffel IX.	Dense	35	36·3	4·6	1,255	0·552	145	2,930	269
Group IX.	,,	38	38·5	5·4	1,180	0·534	190	3,900	218
Schiffel IX.	,,	40	44·6	5·5	964	0·535	159	3,850	173

The height-growth of the group lies somewhat below that of Schiffel's Class IX. dense canopy. The diameter comes out too large, and the number of trees is too great; consequently the volume is somewhat too large. This group was laid out along a thin belt with poor Scotch pine growing on each side, and although every care was taken to exclude marginal trees, it is considered that the great amount of light reaching the trees from both sides may be responsible in part for the large diameter.

GROUP XIII.—1,530 *ft. Elevation.*

Quality Class.	Canopy Density.	Age.	*H.*	*D.*	*N.*	*f.*	*A.*	*V.*	*C.*
		Years.	*Ft.*	*In.*			*Sq. ft.*	*Cub. ft.*	
Schiffel IX.	Medium	35	40·3	5·2	920	0·509	137	2,770	177
Group XIII.	„	38	41·5	5·8	900	0·542	168	3,780	155
Schiffel IX.	„	40	47·9	6·3	720	0·499	156	3,670	114

The height-growth of this group lies slightly below that of Schiffel's Class IX. medium density of canopy. The crop characteristic corresponds very well, as does the mean diameter, but the number of trees per acre is somewhat high, and this, with a larger form factor, gives too high a volume per acre.

A comparison of this group with Group IX., which lies very close to it, shows that both correspond very closely to Quality Class IX., and differ from each other according to their densities in exactly the way Schiffel's Tables would lead one to expect.

Degree of Approximation Attained.

The leading fact brought out by the comparison of the above groups with Schiffel's Tables is that the diameter has been consistently larger in the former. In the first instance, these trees were girthed, and it was then found that the calculated diameters were too large. The groups were consequently carefully calipered after a season's growth, and the results (as indicated on p. 12) are those utilised above.

It would hardly be expected that groups which have been treated somewhat irregularly would show perfect accordance with ideal woods, and it must be noted in this connection that Group I., which was the best grown crop, shows the nearest approximation to the tables. Group IA. is also reasonably close, although it has been neglected for a number of years. Neglect has been of less importance in this particular case, since the canopy has been dense throughout. It is quite conceivable that groups such as V. and VI. should show greater diameters than indicated in the tables. In such exposed positions the leading shoots are frequently broken back by the wind, and consequently the height-growth suffers considerably; but the diameter-growth only to a much smaller extent. Determination of the quality class on the basis of age, height and canopy density is therefore likely to give low results.

The differences indicated between the diameters (and volumes) of these sample plots and the tables may be due to differences of climate or to other causes. The determination of volume by the means adopted might easily lead to an error of ± 10 per cent., with a tendency to give results always too high.[*]

On the other hand, the greater volume shown by the more exposed groups (*e.g.*, Nos. V. and VI.) is quite possibly a natural feature of the growth of spruce. Such a difference is, in fact, to be noted in the Swiss Yield Tables for the spruce.[†] These tables are divided into two sets, the one for hilly country (*Hügelland*), and the other for the mountains (*Gebirge*). Comparison of the two sets of tables indicates that for a given height the latter always show a greater volume, the difference, being greatest with the poorer soils, and amounting in some cases to over 10 per cent. The table below illustrates this point:—

Yield Table.	Quality Class.	Age.	Height in feet.	Diameter in inches.	Stems per acre.	True Vol. per acre, cb. ft.
Hügelland ...	I.	30	46·9	5·6	1100	4410
Gebirge ..	(best)	35	47·5	5·7	1112	4660
Hügelland ...	II.	40	56·8	6·3	936	6180
Gebirge ...		50	56·8	6·8	892	6600
Hügelland ...	III.	35	43·6	5·0	1440	3530
Gebirge ...		45	42·3	5·3	1368	4060
Hügelland ...	IV.	40	43·3	4·8	1520	3470
Gebirge ...		55	42·6	5·2	1276	3840
Hügelland ...	V.	45	43·0	4·0	1640	3180
Gebirge ...	(worst)	70	42·6	5·0	1128	3560

Yield Tables Employed.

After a full consideration of the case it was considered that a reasonable enough degree of approximation had been attained to justify the use of the tables for survey purposes. The measurements of crops made in this somewhat crude way could not be expected to show a much closer coincidence with ideal woods, and in any case it appears that by using these tables a low estimate of volume is made, especially as regards exposed localities.

It was further decided that the medium density of canopy should be taken as the standard, since the district is on the whole exposed, and it is advisable to give the individual trees as large a root system as possible in order to strengthen them against wind.

---

[*] See Flury, *Mitt. der Schweiz. Centralanstalt für das forstliche Versuchswesen*, Vol. VI.

[†] *Ibid.* Vol. VII.

To facilitate surveying, it is advisable, in the first place, to set an elevation limit, above which it would be impossible to plant with any hope of commercial success.

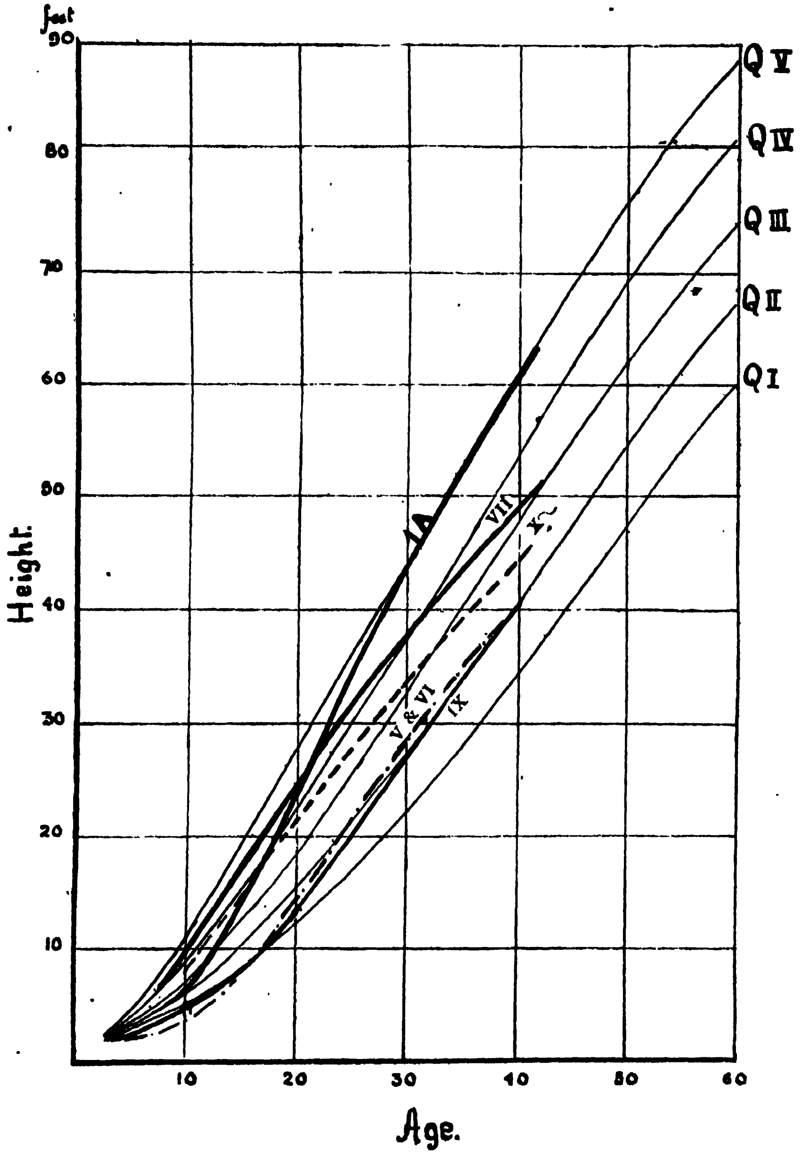


DIAGRAM SHOWING HEIGHT-GROWTH CURVES OF QUALITY CLASSES I—V (SCHIFFEL'S VII—XI), AND OF VARIOUS SAMPLE SPRUCES.

To arrive at a decision on this point, Groups V. and VI. must be further considered. These groups, as already pointed out, lie at an elevation of 1,525 ft. under full exposure to the west and south-west winds. According to their present condition, the locality corresponds to Schiffel's Quality Class VIII., medium density. In the diagram on p. 41 the mean height-growth curves for the various quality classes (medium density of canopy) have been drawn, and the height-growth curves of the sample trees of Groups IA., VII., V., and VI., and IX. superimposed. The height-growth curve of another sample tree (10) from a group too small to measure (Plate VII.), growing under slightly better conditions, has also been added for purposes of comparison. These curves show what might have been anticipated, viz., that the trees of Groups V. and VI. began to grow at a greater rate than the present quality class in which they stand, but as they developed and the tops became more and more exposed, the height-growth began to fall off. Consideration of the curves shows that Groups V. and VI. will probably fall to Quality Class VII. at the age of 60 years. The probability is that the crop would not stand a longer rotation than this owing to danger from windfall.

It is now necessary to consider what returns will be obtained from a crop of Quality VII.

In the following table the value to which the gross returns must amount per acre on a 60 and on an 80 year rotation, in order to give a specific soil rental, have been worked out, assuming the cost of planting to be £5 per acre, the upkeep 4*s*. per acre per year, and the rate of interest 3 per cent.

Soil Rental.	Gross Value of Returns per acre to Produce Given Rent.		Maximum Sum which could be Paid for Freehold per acre (= Soil Expectation Value).	
	Under 60 Years' Rotation.	Under 80 Years' Rotation.	Under 60 Years' Rotation.	Under 80 Years' Rotation.
	£	£	£ *s*. *d*.	£ *s*. *d*
1*s*.	70	134	1 8 0	1 10 0
3*s*.	86	166	4 3 0	4 11 0
5*s*.	103	198	6 19 0	7 11 0
7*s*.	119	230	9 14 0	10 11 0
9*s*.	135	262	12 9 0	13 12 0
11*s*.	152	294	15 5 0	16 12 0
13*s*.	168	326	18 0 0	19 13 0
15*s*.	184	359	20 16 0	22 13 0
17*s*.	201	391	23 11 0	25 13 0
19*s*.	217	423	26 6 0	28 14 0

The last two columns of this table also give the present value of the rents per annum for the next 60 or 80 years as the case may be, or, in other words, the "soil expectation value." * If the land

---

* The term "soil expectation value" is used here in a restricted sense for a single rotation only and not, as is common, for perpetuity. Owing to the degree of uncertainty which attaches to these calculations, the method adopted is considered accurate enough for the purposes in view. A table giving the soil expectation values for spruce for perpetuity will be found in Appendix D, page 64.

PLATE VII.

were purchased, the value of the returns in the second or third columns could be less by the amount of the purchase money, since the land would have a value, presumably its present value, at the end of the rotation.

The tables in Appendix C., pp. 59–63, have in part been taken direct from Schiffel's tables by merely converting the metric into the English system, and assuming that the prices indicated on p. 33 will be obtained for the produce.

For Schiffel's Quality Class VII., the total value of the produce to the end of a 60 year rotation is £86, which is equivalent to a soil rental of 3*s.* per acre.

The value of rough mountain grazing land in this neighbourhood varies from 2*s.* 6*d.* to 5*s.* per acre per year, so that it is evident that a soil rental of 3*s.* from forest is the minimum below which it would be inadvisable, as a general rule, to go.

It would therefore appear that the maximum elevation under full exposure is approximately that of Groups V. and VI., *i.e.*, about 1,525 ft.

The returns from the different quality classes are summarised in the following table :—

Quality Class. (See Appendix C.)	Return on 60 years' rotation.		Return on 80 years' rotation.	
	Total Value at end.	Equivalent Soil Rental per acre per year.	Total Value at end.	Equivalent Soil Rental per acre per year.
	£	*s.*	£	*s.*
I.	86	3	—	—
II.	109	6	—	—
III.	136	9	281	10
IV.	176	13 to 14	319	12 to 13
V.	206	18	364	15 to 16

If now each sample group be put in its proper quality class it is possible to tabulate the data on which a forestry survey may be carried out.

Sample Group.	Elevation.	Aspect.	Exposure.	Quality Class.	Soil Rental obtainable under Forest.
	ft.				*s.*
I.	1,020	N.	Nil.	IV.—V.	15
IA.	1,020	N.	,,	V.	16 to 18
III.	1,460	Flat to N.	½ full	II.—III.	8 to 9
V.	1,525	,,	,,	I.—II	3
VI.	1,525	.. S.	full	I.—II.	3
VII.	1,400	S.W.	½ full	III.	9
IX.	1,530	N.	¼ ,,	II.	6
XIII.	1,530	N.	¼ ,,	II.	6

As a basis for a survey, this number of determinations is, of course, far too small, but it forms, nevertheless, an excellent guide for the immediate neighbourhood, and to enlarge the scope of the survey all that is necessary is to extend the observations in all directions. Once the applicability of a yield-table to a district can be proved, it is possible to utilise as a check on the work the height-growth of trees in groups which are too small for accurate volume determinations.

It is found in the field that variations in quality of locality are so rapid that it is impossible to map land rapidly and effectively into five grades. Three grades are sufficient for the purpose, and might be called "poor," "medium," and "good," with probable soil rentals in this district for forestry purposes of 4*s.*, 10*s.*, and 15*s.* per acre.

As "poor" may be designated the flat tops of hills up to 1,500 ft., or even 1,530 ft., steep west and south-west slopes under full exposure, and north slopes of 1,550 ft. to 1,600 ft. where well protected. Under "medium" quality come north and east slopes of from 1,250 ft. to 1,500 ft., and west and south-west slopes of from 1,000 ft. to 1,400 ft. where sheltered by hills to windward and not exposed to winds sweeping up valleys "Good" conditions include land up to 1,250 ft. on sheltered east and north aspects and at the bottom of sheltered valleys generally.

"Good" land will carry larch, Douglas fir, and spruce if so desired; "medium" quality land, larch artificially protected by shelter belts, as well as Corsican pine, but principally spruce; and "poor" land, spruce only.

No attempt is made, in the absence of reliable yield tables, to calculate the financial results of growing larch and Douglas fir, but it may be assumed from the general information available that both species, and particularly the latter, will give better results than spruce on "good" land. The spruce tables therefore indicate the minimum returns which may be expected from forests on this type of soil.

Application of Results of a Survey to Afforestation Schemes.

A survey of the type suggested answers the vexed question as to what area of land in a given district would give a larger rent under forest than under present methods of utilisation. It is obvious that no adequate national scheme of afforestation can be framed until the area of land ultimately to be afforested is known with a fair degree of approximation, and that no scheme will find public support unless supported by accurate data as to the returns which may be expected.

A change from one form of soil utilisation to another, however, must be accompanied by a change in the life of the inhabitants of the district, and, as has been very clearly pointed out in the recent forestry survey of Glen Mor,* this may become a question of great importance. Concurrently with the survey, therefore, inquiries as to the probable economic changes must be made.

A survey of this sort gives roughly the value for forestry purposes of each acre of land surveyed, from the time it is put under crop. When a large area of land is purchased for afforestation purposes, however, it is not planted up in a single year, and for a considerable portion of the first rotation only a part of the land must be managed as a forest, the remainder being utilised as before. In addition, there will be certain expenses of a general nature which have not been included in valuing the soil, such as the provision of buildings, building of roads, clearing off stock, and so on. These are questions which will differ with every specific area which it is proposed to afforest.

As a preliminary to the purchase of a definite area for afforestation purposes, or to the formation of a joint afforestation scheme between a landlord and the State, procedure on the following lines is suggested:—

1. A detailed survey of the area.

2. The preparation of a general working plan, showing as a minimum the order to be followed in planting.

3. A calculation of the probable value of the soil for forestry purposes.

4. Estimation of the probable value of the whole area as a forest after making proper allowances for unforeseen contingencies, such as damage to crops from insects, fire, and meteorological causes.

With regard to the preparation of the working plan it is unnecessary to say anything here.

The calculation as to the probable value of the land under forest may be made on the following lines:—

Let A_1, $A_2 \ldots\ldots A_r$ be the areas to be afforested in the years 1, 2……r.

Let S_1, $S_2 \ldots\ldots S_r$ be the average soil expectation value of the land afforested in the years 1, 2……r.

Let g_1, $g_2 \ldots\ldots g_r$ be the average grazing value per acre of the areas A_1, $A_2 \ldots\ldots A_r$.

Then the present value of the area A_n, say, is the present value of all grazing rents up to the (n-1)th year (or year of enclosure), plus the present value of the soil expectation value in the nth year

$$\begin{aligned} &= \text{present value } (A_n.g_n \text{ for } (n-1) \text{ years}) \\ &+ \quad \text{,,} \quad \text{,,} \quad (A_n.S_n \text{ due in } n \text{ years}) \\ &= \text{say, } V_n. \end{aligned}$$

---

* *Trans: Royal Scottish Arboricultural Society*, Vol. XXV.

Then the total present gross value of the whole area for forestry purposes $= \Sigma V_n$.

In the same way the sum of the present values of all expenses, such as buildings and roads not included in calculating the soil expectation value, may be represented by ΣE.

Then the net value of the area for forestry purposes $= \Sigma V_n - \Sigma E$.

If the value of the quantity $(\Sigma V_n - \Sigma E)$ be now reduced by some factor (say 25 per cent.) as a margin against risks, a figure is reached which approximates to the highest sum which can be given for the whole of the land if the operations are to yield a minimum return of 3 per cent. (in the present calculations) on all capital invested.

Calculations on these lines reduce the necessity for guesses and the risk of loss to a minimum. The difficulty, as a rule, is to estimate the soil expectation value owing to lack of reliable data on tree growth.

B. Systematic Method of Conducting a Survey.

A systematic survey should proceed on the following lines:—

(1) Districts should be established corresponding as far as possible with the general conditions of forest growth.

(2) The woods in each district should be visited, and the following points noted:

(*a*) Age and composition of the wood; whether pure, mixed, &c.

(*b*) General condition of the wood and the probability of a further detailed examination yielding useful data.

(3) The woods noted under 2 (*b*) above should be examined with special reference to aspect, elevation, volume per acre—both actually standing and under fully stocked conditions—soil, &c.

(4) The physical and chemical properties of the soil should be examined where necessary.

(5) The information collected should be correlated and analysed, and the limits of profitable forestry determined:

(*a*) As far as indicated by data gathered within the district.

(*b*) As far as can be determined from data gathered outside the district, but reasonably applicable within it.

(6) The district should be mapped for afforestation purposes, the available area determined, and the economic side of the question studied.

C. Summary.

The selection of land for afforestation may proceed on one of two lines.

(1) It can be taken for granted that afforestation will pay. The

ground can then be mapped into its suitability for various species, and planted up according to a pre-arranged scheme. The surveying can in such case be carried out by experienced local foresters. The method precludes the employment of a permanent staff for the work, since without a proper study of local conditions a man cannot efficiently survey land. Without a permanent staff there arises a difficulty in co-ordination and a danger that a future generation may regard the work with suspicion.

This method gives no financial basis to go upon, and puts the whole business on an uncertain footing.

(2) The second method is to investigate the commercial aspect of afforestation in a district, and to start the work of surveying or scheduling the land on the basis of accurate information. There is in such case a check on the personal proclivities of the surveyor, and the work is founded on recorded facts. A permanent staff, assisted by local foresters, is necessary. It is on the lines of this method that the work at Kerry has been carried on.

Consideration of the whole question leads to the following conclusions :—

In a forestry survey the determination of the area of land which will grow trees well is only one of a number of important points. A survey in a district presupposes that some scheme of afforestation may follow. Hence the survey should supply as much as possible of the information which is necessary for the framing of such a scheme. The difficulties which will be encountered in framing a scheme are briefly these :—

(1) The determination of the area and distribution of the land available.

(2) The forecast of the financial results.

(3) The disturbances created in putting the scheme into operation.

A survey must strive to solve these difficulties as far as may be possible, and there is only one way of doing this, viz., the collection and analysis of statistics in the district and its neighbourhood. The safest basis for the estimation of the volume of timber which will be produced on a given piece of land is the volume which it has carried under a previous and similar crop. From this degree of accuracy one passes step by step to the comparison of bare and wooded areas side by side, and finally to the bare hillside with no indicating woods, at any rate of a satisfactory character, for miles around.

The collection of statistics of the sort gathered at Kerry will place the surveyor in the position that he will be able to indicate three broad types of land :—

(1) Land on which afforestation should under proper management prove a success.

(2) Land on which success is doubtful owing to lack of sufficient

information as to the growth of timber on that particular type of land.

(3) Land on which profitable forestry appears to be impossible.

The obvious procedure is to afforest land of the first type, and to institute experiments on the very large areas belonging to the second and third types, postponing any extended planting scheme until the experiments have afforded definite results.

APPENDICES

PAGE

Appendix A.—Mechanical and Chemical Analyses of Soil Samples 50

Appendix B.—Details of Caliper Measurements of Sample Areas 54

Appendix C.—Volume and Money Yield Tables for Spruce (after Schiffel) 59

Appendix D.—Soil Expectation Values for Spruce 64

APPENDIX A.

TABLE I.—MECHANICAL ANALYSIS OF SAMPLES OF SOIL FROM KERRY, MONTGOMERYSHIRE.

MECHANICAL ANALYSIS.	1A.		2.		3.		5 and 6.		8.		9.		12.	
	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil
Stones, above 3 mm. (to 100 parts of fine earth)	109	232	86	144	25	82	25	96	90	131	45	101	11	22
Percentage of fine earth.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent	Per cent.	Per cent.	Per cent.	Per cent.
Fine gravel above 1 mm.	21·7	18·9	14·1	11·0	12·1	16·0	1·2	2·5	1·6	4·6	2·4	3·8	0·7	5·4
Coarse sand, 1–0·2 mm.	12·6	10·3	5·9	10·5	7·6	9·1	1·3	1·9	1·5	2·9	3·0	3·0	2·8	10·1
Fine sand, 0·2–0·04 mm.	12·3	13·6	4·1	6·7	6·7	8·6	8·4	10·9	7·5	6·9	13·6	15·5	17·0	16·6
Silt, 0·04–0·01 mm.	25·5	27·5	25·9	28·4	28·1	28·1	33·6	36·5	34·7	36·3	30·8	31·4	26·6	22·6
Fine silt, 0·01–0·005 mm.	11·2	10·3	12·0	13·3	14·0	13·2	15·7	15·4	15·5	13·8	13·1	13·2	16·8	14·8
Fine silt, 0·005–0·002 mm.	4·4	5·9	8·0	7·4	8·0	7·3	11·1	7·2	11·8	9·1	8·2	8·4	12·0	10·1
Clay, below 0·002 mm.	2·2	5·6	15·1	11·5	10·8	9·4	12·8	16·8	10·5	17·0	16·1	15·1	17·1	14·6
Moisture	1·3	1·1	2·8	1·6	1·6	1·3	2·2	1·3	2·3	1·6	2·5	1·4	1·1	0·9
Loss on ignition	7·4	5·5	9·9	7·5	10·2	6·1	12·1	6·1	13·0	7·3	9·0	6·4	4·3	4·2
Calcium Carbonate soluble in N/5 HCl.	1·1	0·9	3·0	1·9	2·8	1·5	1·8	1·5	2·0	1·0	1·6	1·5	1·2	0·9
TOTAL	99·7	99·6	100·8	99·8	101·9	100·6	100·2	100·1	100·4	100·5	100·3	99·7	99·6	100·2

TABLE I. (*continued*).—MECHANICAL ANALYSIS OF SAMPLES OF SOIL FROM KERRY, MONTGOMERYSHIRE.

MECHANICAL ANALYSIS.	Cefn Golog : No. A.		L. 1		L. 3.		L. 4.		L. 6.	
	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.
Stones, above 3 mm. (to 100 parts of fine earth)	128	67	31	78	62	170	43	142	38	145
Percentage of fine earth.	per cent.	per cent.	per cent	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Fine gravel, above 1 mm.	3·2	6·8	2·9	5·8	2·3	8·3	1·1	8·6	0·7	1·6
Coarse sand, 1—0·2 mm....	2·2	4·0	2·3	6·6	3·6	7·8	1·6	8·6	1·4	2·3
Fine sand, 0·2—0·04 mm.	14·5	21·9	12·1	14·7	14·4	16·8	15·2	12·6	10·6	14·8
Silt, 0·04—0·01 mm.	28·8	28·5	29·5	30·3	31·8	32·3	32·3	29·9	32·9	33·2
Fine silt, 0·01—0·005 mm.	13·5	11·3	17·1	15·4	16·6	12·5	15·9	13·2	19·5	14·2
Fine silt, 0·005—0·002 mm.	4·9	6·1	12·1	7·2	10·2	6·2	10·2	6·6	9·9	9·7
Clay, below 0·002 mm.	9·5	10·3	11·6	14·1	8·8	10·3	10·1	13·1	6·9	12·9
Moisture	3·2	1·9	1·7	1·1	1·9	1·0	2·6	1·9	3·7	2·3
Loss on ignition	15·6	5·2	7·6	3·1	6·4	3·1	5·8	2·4	7·5	4·6
Calcium Carbonate soluble in N/5 HCl.	3·0	2·1	2·0	0·9	1·7	1·5	2·0	1·3	2·2	1·8
TOTAL	98·4	98·1	98·9	99·2	97·7	99·8	96·8	98·2	95·3	97·4

TABLE II.—CHEMICAL ANALYSIS OF SAMPLES OF SOIL (PER CENT)

	1A.		2		3.		5 and 6		8.		9.		12.	
	Soil.	Subsoil.	Soil	Subsoil	Soil.	Subsoil.	Soil	Subsoil	Soil	Subsoil	Soil	Subsoil.	Soil	Subsoil.
Moisture	1·32	1·06	2·77	1·56	1·58	1·28	2·16	1·30	2·28	1·62	2·46	1·36	1·08	0·92
Loss on ignition	8·68	6·63	12·72	9·08	11·76	7·44	14·32	7·40	15·32	8·93	11·50	7·82	5·42	5·06
Nitrogen	0·228	0·147	0·036	0·091	Nil	0·091	Nil	0·112	Nil	Nil	Nil	0·051	Nil	Nil
Al O₃	4·53	—	5·12	—	5·39	—	5·63	—	6·33	—	5·24	—	7·75	—
Fe_2O_3	5·12	—	3·78	—	5·79	—	5·14	—	4·73	—	5·36	—	6·38	—
Mn_3O4	0·12	—	0·11	—	0·11	—	0·22	—	0·13	—	0·17	—	0·19	—
MgO	1·70	—	1·16	—	1·66	—	0·99	—	1·36	—	1·20	—	2·06	—
CaO	0·28	—	Nil	—	Nil	—	Nil	—	Nil	—	Nil	—	Nil	—
Carbonates as $CaCO_3$	0·054	0·041	0·073	0·051	0·037	0·047	0·046	0·036	0·054	0·057	0·055	0·053	0·043	0·029
Potash as K_2O	0·79	0·65	0·75	0·86	0·87	0·73	0·65	0·81	0·77	0.81	0·66	0.88	1·41	1·27
Do., Soluble in 1 % Citric Acid ..	0·014	—	0·013	—	0·008	—	0·012	—	0·013	—	0·012	—	0·007	—
P_2O_5	0.17	0·15	0·10	0·11	0·10	0·09	0·12	0·10	0·16	0·14	0·16	0·14	0·06	0·09
Do., Soluble in 1 % Citric Acid ..	0·034	—	0·023	—	0·025	—	0·031	—	0·025	—	0·031	—	0·007	—
SO_3	0·03	—	0·10	—	0·02	—	0·10	—	0·14	—	0·12	—	0·03	—

TABLE II. (*continued*).—CHEMICAL ANALYSIS OF SAMPLES OF SOIL (PER CENT.)

	Cefn Golog. No. A.		L. 1.		L. 3.		L. 4.		L. 6.	
	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.
Moisture	3·18	1·92	1·72	1·14	1·88	1·02	2·56	1·86	3·68	2·26
Loss on Ignition	18·84	7·07	9·31	4·24	8·32	4·08	8·40	4·34	11·20	6·94
Nitrogen	0·46	0·03	Nil.	0·06	Nil.	0·07	0·25	0·08	0·38	Nil.
Al_2O_3	4·24	—	6·92	—	5·96	—	6·73	—	5·41	—
Fe_2O_3	2·36	—	5·36	—	5·04	—	5·28	—	4·57	—
Mn_3O_4	0·14	—	0·16	—	0·14	—	0·12	—	0·25	—
MgO	0·18	—	1·39	—	1·64	—	1·51	—	1·20	—
CaO	Nil.	—	Nil.	—	Nil.	—	Nil.	—	Nil.	—
Carbonates, as $CaCO_3$	0·05	0·07	0·067	0·044	0·057	0·045	0·074	0·056	0·078	0·060
Potash, as K_2O	0·68	0·76	1·03	0·91	0·83	0·78	0·72	0·73	0·61	0·83
Do. Soluble in 1% Citric Acid	0·007	—	0·011	—	0·023	—	0·011	—	0·015	—
P_2O_5	0·191	0·187	0·22	0·11	0·199	0·159	0·187	0·171	0·22	0·11
Do. Soluble in 1% Citric Acid	0·033	—	0·022	—	0·046	—	0·024	—	0·029	—
SO_3	0·06	—	0·06	—	0·05	—	0·09	—	0·07	—

APPENDIX B

DETAILS OF CALIPER MEASUREMENTS OF SAMPLE AREAS.

Diameters calipered at breast height (4 ft. 3 in. above the ground.)

GROUP L_1. *Area*, 0·3 acre.

Diameter Class	Dominant Crop.		Minor Crop.	
	Number.	Basal Area	Number.	Basal Area.
inches.		sq ft.		sq. ft.
3	—	—	2	0·0982
4	—	—	7	0·6111
5	17	2·3188	15	2·0460
6	44	8·6372	4	0·7852
7	45	12·0285	1	0·2673
8	22	7·6802	—	—
9	4	1·7672	—	—
—	132	32·4319	29	3·8078

GROUP L_2. *Area*, 0·156 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
inches.		sq. ft.		sq ft.
3	—	—	4	0·1964
4	3	0·2619	14	1·2222
5	30	4·0920	6	0·8184
6	32	6·2815	1	0·1963
7	11	2·9403	—	—
8	8	2·7928	—	—
9	1	0·4418	—	—
—	85	16·8103	25	2·4333

GROUP L$_3$. *Area,* 0·2 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
inches.		sq. ft.		sq. ft.
2	—	—	1	0·0218
3	1	0·0491	8	0·3928
4	12	1·0476	8	0·6984
5	35	4·7740	3	0·4092
6	38	7·4594	—	—
7	15	4·0095	—	—
8	1	0·3491	—	—
9	1	0·4418	—	—
—	103	18·1305	20	1·5222

GROUP L$_4$. *Area,* 0·2 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
inches.		sq. ft.		sq. ft.
2	—	—	4	0·0872
3	—	—	6	0·2946
4	7	0·6111	20	1·7460
5	39	5·3196	9	1·2276
6	26	5·7038	1	0·1963
7	21	5·6133	—	—
8	1	0·3491	—	—
—	94	17·5969	40	3·5517

GROUP II. SCOTCH PINE. *Area,* 0·225 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
inches.		sq. ft.		sq. ft.
4	—	—	2	0·1746
5	5	0·6820	8	1·0912
6	21	4·1223	12	2·3556
7	39	10·4247	—	—
8	26	9·0766	1	0·3491
9	10	4·4180	—	—
10	4	2·1816	—	—
—	105	30·9052	23	3·9705

GROUP I. NEW POOL SPRUCE. *Area,* 0·2

Diameter Class.	Dominant Crop.		Min	
	Number.	Basal Area.	Number.	ea.
inches.		sq. ft.		sq. ft.
5	—	—	3	0·4092
6	—	—	14	2·7482
7	12	3·2076	12	3·2076
8	24	8·3784	2	0·6982
9	32	14·1376	1	0·4418
10	15	8·1810	—	—
11	7	4·6200	—	—
12	2	1·5708	—	—
—	92	40·0954	32	7·5050

GROUP IA. NEW POOL SPRUCE. *Area,* 0·125 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
inches.		sq. ft.		sq. ft.
4	—	—	10	0·8730
5	—	—	16	2·1824
6	13	2·5519	16	3·1408
7	18	4·8114	4	1·0692
8	16	5·5856	—	—
9	16	7·0688	1	0·4418
10	5	2·7270	—	—
11	5	3·3000	—	—
12	2	1·5708	—	—
—	75	27·6155	47	7·7072

GROUP III. SPRUCE: CEFN CRAIG WOOD. *Area,* 0·154 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
inches.		sq. ft.		sq. ft.
4	—	—	3	0·2619
5	2	0·2728	5	0·6820
6	5	0·9815	4	0·7852
7	15	4·0095	5	1·3365
8	16	5·5856	3	1·0473
9	19	8·3942	—	—
10	11	5·9994	—	—
11	4	2·6400	—	—
—	72	27·8830	20	4·1129

GROUP V. SPRUCE SHELTER BELT, EAST OF KERRY POLE COTTAGE.

Area, 0·1 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
inches.		sq. ft.		
4	1	0·0873	3	0·2619
5	14	1·9096	15	2·0460
6	29	5·6927	3	0·5889
7	33	8·8209	—	—
8	7	2·4437	—	—
—	84	18·9542	21	2·8968

GROUP VI. *Area,* 0·221 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
inches.		sq. ft.		sq. ft.
3	—	—	1	0·0491
4	2	0·1746	23	2·0079
5	50	6·8200	34	4·6376
6	96	18·8448	7	1·3741
7	42	11·2266	—	—
8	7	2·4437	—	—
—	197	39·5097	65	8·0687

GROUP VII. NANT-Y-RHYNAU WOOD. *Area,* 0·2 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
inches.		sq. ft.		sq. ft.
5	—	—	6	0·8184
6	15	2·9445	29	5·6927
7	56	14·9688	6	1·6038
8	38	13·2658	—	—
9	11	4·8598	—	—
10	3	1·6362	—	—
—	123	37·6751	41	8·1149

GROUP IX. CEFN GOLOG WOOD. *Area,* 0·213 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area	Number.	Basal Area.
inches.		sq. ft.		sq. ft.
2	—	—	5	0·1090
3	—	—	21	1·0311
4	37	3·2301	36	3·1428
5	113	15·4132	8	1·0912
6	76	14·9188	—	—
7	22	5·8806	—	—
8	3	1·0473	—	—
—	251	40·4900	70	5·3741

GROUP XII. CORSICAN PINE. *Area,* 0·146 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basa Area.
inches.		sq. ft.		sq. ft.
5	—	—	1	0·1364
6	—	—	2	0·3926
7	8	2·1384	4	1·0692
8	7	2·4437	4	1·3964
9	6	2·6508	5	2·2090
10	11	5·9994	—	—
11	13	8·5800	—	—
12	12	9·4248	—	—
13	7	6·4526	—	—
14	—	—	—	—
15	1	1·2272	—	—
—	65	38·9169	16	5·2036

GROUP XIII. CEFN GOLOG WOOD. *Area,* 0·218 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
inches.		sq. ft.		sq. ft.
3	—	—	3	0·1473
4	9	0·7857	21	1·8333
5	66	9·0024	17	2·3188
6	86	16·8818	2	1·1778
7	32	8·5536	—	—
8	4	1·3964	—	—
—	197	36·6199	43	5·4772

APPENDIX C.

VOLUME AND MONEY YIELD TABLES FOR SPRUCE (AFTER SCHIFFEL).

QUALITY CLASS I.—(SCHIFFEL'S CLASS VII. MEDIUM DENSITY OF CANOPY).

Age.	DOMINANT CROP.					Crop Character-istic.	THINNINGS.					Total Value at 60 Years.
	Mean Height.	Mean Diameter.	Number of Trees per acre.	Form Factor.	True Volume per acre.		Number of Trees per acre.	True Volume per acre.	Assumed price per cubic foot.	Value at time felled.	Value at end of Rotation at 3 per cent.	
	feet	inches			cubic feet			cubic feet		£	£	£
10	4·9	--	—	—	—	—	—	—	—	—	—	—
15	8·5	0·9	2,834	1·000	100	3,149	—	—	—	—	—	—
20	12·1	1·5	2,834	0·705	300	1,889	—	—	—	—	—	—
25	16·4	2·0	2,834	0·629	615	1,417	—	—	—	—	—	—
30	22·0	2·6	2,113	0·593	1040	813	721	129	—	—	—	—
35	27·9	3·4	1,587	0·568	1570	467	526	200	—	—	—	—
40	34·1	4·3	1,186	0·544	2170	276	401	315	*1d.*	1·312	2·37	Value of thinnings £21·55
45	40·7	5·2	907	0·527	2860	174	279	386	*2d.*	3·217	5·01	
50	47·6	6·2	713	0·509	3630	115	194	458	*2d.*	3·817	5·13	Value of final felling at *3d.* per cubic foot £64·50
55	53·8	7·2	587	0·500	4400	82	126	458	*2d.*	3·817	4·43	
60	59·7	8·0	502	0·491	5160	63	(85)	(443)	*2½d.*	4·61	4·61	
									TOTAL RETURNS		... ...	£86·05

QUALITY CLASS II.—(SCHIFFEL'S CLASS VIII. MEDIUM DENSITY OF CANOPY).

Age.	Dominant Crop.					Crop Characteristic.	Thinnings.					Total Value at 60 Years.
	Mean Height.	Mean Diameter.	Number of Trees per acre.	Form Factor.	True Volume per acre.		Number of Trees per acre.	True Volume per acre.	Assumed price per cubic foot.	Value at time felled.	Value at end of Rotation at 3 per cent.	
	feet	inches			cubic feet			cubic feet		£	£	£
10	6·2	—	—	—	—	—	—	—	—	—	—	—
15	10·5	—	—	—	—	—	—	—	—	—	—	—
20	15·7	1·9	2,968	0·636	570	1,562	—	—	—	—	—	—
25	21·3	2·5	2,231	0·596	990	892	737	114	—	—	—	
30	27·2	3·3	1,623	0·562	1,490	492	607	215	—	—	—	
35	33·5	4·2	1,215	0·536	2,070	289	409	300	1*d.*	1·25	2·61	Value of thinnings £31·44 Value of final felling at 3*d.* per cubic foot £77·87
40	40·3	5·1	939	0·525	2,830	184	275	358	2*d.*	2·983	5·39	
45	47·6	6·1	735	0·509	3,660	120	204	458	2*d.*	3·817	5·95	
50	54·4	7·2	591	0·497	4,520	82	144	515	2*d.*	4·292	5·75	
55	61·0	8·2	494	0·487	5,380	60	97	515	2½*d.*	5·364	6·22	
60	67·2	9·2	422	0·479	6,230	46	(72)	(530)	2½*d.*	5·52	5·52	
									TOTAL RETURNS			£109·31

QUALITY CLASS III. (SCHIFFEL'S CLASS IX. MEDIUM DENSITY OF CANOPY).

Age.	DOMINANT CROP.					Crop Characteristic.	THINNINGS.						Total value at end of 60 Years' Rotation.	Total value at end of 80 Years' Rotation.
	Mean Height.	Mean Diameter.	Number of Trees per acre.	Form Factor.	True Volume per acre.		Number of Trees per acre.	True Volume per acre.	Assumed price per cubic foot.	Value at time felled.	Value at 60 years at 3 per cent.	Value at 80 years at 3 per cent.		
	feet	inches			cubic feet			cubic ft.		£	£	£	£	£
10	7·5	—	—	—	—	—	—	—	—	—	—	—	—	—
15	12·5	—	—	—	—	—	—	—	—	—	—	—	—	—
20	18·7	2·2	2652	0·622	800	1205	—	—	—	—	—	—	Value of thinnings £44·40 Value of final felling at 3*d.* per cubic foot £91·87	
25	25·5	3·0	1860	0·577	1370	620	792	200	—	—	—			
30	32·8	4·1	1280	0·541	2030	312	580	343	1d.	1·429	3·47	6·26		
35	40·3	5·2	920	0·509	2770	177	360	443	2d.	3·692	7·73	13·96		Value of thinnings £108·70 Value of final felling at 4*d.* per cubic foot £172·50
40	47·9	6·3	720	0·499	3670	114	200	443	2d.	3·692	6·67	12·04		
45	55·1	7·3	590	0·491	4620	81	130	472	2d.	3·933	6·13	11·07		
50	62·0	8·3	495	0·483	5560	60	95	529	2½d.	5·510	7·40	13·37		
55	68·6	9·3	420	0·477	6490	45	75	543	2½d.	5·656	6·56	11·84		
60	74·5	10·2	370	0·471	7350	36	50	515	3d.	6·437	6·44	11·62		
65	79·7	11·1	330	0·465	7990	30	40	515	3d.	6·437	—	10·03		
70	84·6	11·9	298	0·460	8900	25	32	457	3d.	5·713	—	7·68		
75	89·2	12·6	275	0·458	9650	22	23	415	3d.	5·188	—	6·01		
80	93·5	13·2	255	0·455	10350	19	(20)	(386)	3d.	4·825	—	4·82	—	
										TOTAL RETURNS			£136·27	£281·20

QUALITY CLASS IV.—(SCHIFFEL'S CLASS X. MEDIUM DENSITY OF CANOPY).

Age.	DOMINANT CROP.					Crop Characteristic.	THINNINGS.						Total value at end of 60 Years' Rotation.	Total value at end of 80 Years' Rotation.
	Mean Height.	Mean Diameter.	Number of Trees per acre.	Form Factor.	True Volume per acre.		Number of Trees per acre.	True Volume per acre.	Assumed price per cubic foot.	Value at time felled.	Value at 60 years at 3 per cent.	Value at 80 years at 3 per cent.		
	feet	inches			cubic feet			cubic ft.		£	£	£	£	£
10	8·9	—	—	—	—	—	—	—	—	—	—	—	—	—
15	15·4	—	—	—	—	—	—	—	—	—	—	—	—	—
20	23·3	2·8	2,025	0·578	1,140	730	—	—	—	—	—	—		
25	30·5	3·7	1,446	0·549	1,800	391	579	257	—	—	—	—	Value of thinnings £52·90 Value of final felling at 3½d. per cubic foot £123·52	Value of thinnings £125·64 Value of final felling at 4d. per cubic foot £193·33
30	37·7	4·6	1,085	0·532	2,570	236	361	358	1d.	1·487	3·63	6·54		
35	45·6	5·8	802	0·510	3,460	138	283	500	2d.	4·167	8·73	15·78		
40	54·1	7·1	616	0·493	4,490	87	186	586	2d.	4·883	8·84	15·92		
45	62·0	8·3	494	0·481	5,530	59	122	615	2½d.	6·406	9·99	18·00		
50	69·2	9·4	417	0·473	6,560	44	77	586	2½d.	6·103	8·18	14·83		
55	75·8	10·4	362	0·468	7,550	35	55	558	2½d.	5·812	6·74	12·15		
60	81·7	11·3	320	0·462	8,470	28	42	543	3d.	6·785	6·79	12·29		
65	87·2	12·2	289	0·457	9,350	24	31	500	3d.	6·250	—	9·75		
70	92·2	13·0	264	0·454	10,150	20	25	472	3d.	5·900	—	7·93		
75	96·4	13·7	245	0·452	10,910	18	19	415	3½d.	6·052	—	7·02		
80	100·4	14·3	225	0·450	11,600	16	(16)	(372)	3½d.	5·425	—	5·43	—	
										TOTAL RETURNS			£176·42	£318·97

QUALITY CLASS V. (SCHIFFEL'S CLASS XI. MEDIUM DENSITY OF CANOPY).

Age.	Dominant Crop					Crop Characteristic.	Thinnings.						Total value at end of 60 Years' Rotation.	Total value at end of 80 Years' Rotation.
	Mean Height.	Mean Diameter.	Number of Trees per acre.	Form Factor.	True Volume per acre.		Number of Trees per acre	True Volume per acre.	Assumed price per cubic foot.	Value at time felled.	Value at 60 years at 3 per cent.	Value at 80 years at 3 per cent.		
	feet.	inches.			cubic feet.			cubic ft		£	£	£	£	£
10	11·2	—	—	—	—	—	—	—	—	—	—	—	—	—
15	19·7	2·3	2,515	0·607	858	1,093	—	—	—	—	—	—		
20	27·6	3·3	1,717	0·566	1,545	520	798	229	—	—	—	—		
25	35·8	4·4	1,179	0·534	2,360	268	538	386	1*d.*	1·608	4·52	8·17	Value of thinnings £64·70 Value of final felling at 3½*d.* per cubic foot £141·38	Value of thinnings £147·02 Value of final felling at 4*d* per cubic foot £216·33
30	44·3	5·6	853	0·511	3,320	152	326	586	1*d*	2·441	5·93	10·69		
35	52·8	6·9	642	0·489	4,400	93	211	600	2*d*	5·000	10·47	18·93		
40	61·0	8·1	518	0·482	5,490	64	124	615	2*d.*	5·125	9·28	16·71		
45	68·9	9·3	429	0·474	6,620	46	89	629	2½*d.*	6·550	10·22	18·41		
50	76·1	10·4	366	0·466	7,690	35	63	629	2½*d.*	6·550	8·78	15·92		
55	82·7	11·5	321	0·460	8,740	28	45	586	3*d.*	7·325	8·50	15·31		
60	88·6	12·4	287	0·455	9,695	23	34	560	3*d.*	7·000	7·00	12·62		
65	93·8	13·2	262	0·451	10,580	20	25	486	3*d.*	6·075	—	9·48		
70	98·7	14·0	243	0·449	11,450	17	19	430	3½*d.*	6·271	—	8·38		
75	103·0	14·7	227	0·448	12,230	15	16	400	3½*d.*	5·833	—	6·77		
80	106·9	15·3	214	0·446	12,980	14	(13)	(386)	3½*d.*	(5·629)	—	5·63		
										TOTAL RETURNS	…		£206·08	£363·35

APPENDIX D.

SOIL EXPECTATION VALUES FOR SPRUCE.

Table showing the Expectation Value of Soil of Qualities I. to V. when planted up with and maintained permanently under a Crop of Spruce.

Quality Class.	I.	II.	III.		IV		V	
	60-year Rotation.	60 year Rotation	60-year Rotation.	80 year Rotation	60-year Rotation	80 year Rotation	60-year Rotation.	80 year Rotation.
	£	£	£	£	£	£	£	£
Value of returns at end of a single rotation	86	109	136	281	176	319	206	364
Present value of all future returns (for ever)	17·6	22·3	27·8	29·1	36·0	33·1	42·1	37·6
Capital value of cost of forming plantation now and again at end of every rotation at £5 per acre ...	6·0	6·0	6·0	5·5	6·0	5·5	6·0	5·5
Capital value of cost of upkeep and management at 4/- per acre per year for ever	6·7	6·7	6·7	6·7	6·7	6·7	6·7	6·7
Present value of all expenses (for ever)	12·7	12·7	12·7	12·2	12·7	12·2	12·7	12·2
Soil Expectation Value . .	4·9	9·6	15·1	16·9	23·3	20·9	29·4	25·4

IMPERIAL AGRICULTURAL RESEARCH
INSTITUTE LIBRARY
NEW DELHI.

Date of issue.	Date of issue.	Date of issue.
23 APR 1971		